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Governor Smith Again Proposes State Water-Power Development

HAVING failed to get anywhere with his water-power plans last year, Governor Alfred E. Smith, in his annual message to the Legislature of New York State, takes up the same theme this year but with variations and elaborations. His faith in state ownership has not wavered, and the rejection of the Adirondack water-power amendment by the voters last November has served to strengthen it. However, he has been won over to regional superpower, even though it be with reservations. It will be recalled that last year he sensed a strong and determined propaganda to divert the electrical energy from the border streams to territory outside the state. Apparently this apprehension has vanished, although the Governor fears and impugns the motives of private enterprise as much as ever. To him it is inconceivable that private enterprise should seek any end besides its own financial profit.

The Governor now proposes a brand-new plan for financing water-power development based on the creation of a state power authority similar to the New York Port Authority, with power to issue its own corporate bonds without first obtaining popular sanction. It is doubtful whether the proud Empire State is ready to accept this sort of socialistic venture, and fortunately the line-up in the present Assembly at Albany is such that there is little hope of the Governor having his way this year any more than he did last.

Opportunity for Wider Interconnections

THE map of electric transmission systems which accompanied the ELECTRICAL WORLD of January 5 will bear much study. While it shows in a very striking manner the large amount of interconnection at present in existence, it also indicates to a discerning eye innumerable opportunities for further interconnection. To tie together a string of stations into one network would appear a simple matter with a map of this kind as a guide; but as a matter of fact such a solution, desirable as it is, is not so readily obtained. There are legal, financial and other stumbling blocks in the way. However, a resourceful operator can oftentimes overcome obstacles if it is advantageous to do so, and viewed in the proper light most of these opportunities are advantageous.

Broadly speaking, there should be more general interconnection between privately owned electric light and power stations and those municipally owned. The latter are for the most part small and inefficient and have most to gain. Moreover, there are a large number of privately owned systems which should also be interconnected, and interconnected at once, in the interest of economy and service. False pride has kept these systems apart too long. It is needless to draw attention to the mote in the other fellow's eye when the beam is in our own. The ELECTRICAL WORLD therefore commends its map to the earnest consideration of electric public utility executives. It suggests not only interconnections where none exists, but suggests also unified operation of systems already interconnected. Greater savings are thus made possible and better service should result.

Reducing Inductance in Adjacent Transmission Circuits

WHEN a three-phase transmission line of considerable length is operated under a balanced system of three-phase emfs. at the generator end and with a balanced load at the motor end, the drop of voltage in the three line conductors will be balanced and symmetrical, provided that these three conductors are maintained at equal distances apart all along the line and also provided that no other three-phase line is operating at the same frequency closely parallel to the line considered.

In practice both these limitations are commonly infringed. The three conductors of the line are seldom mounted on their towers at equal spacings, such as would correspond to the vertices of an equilateral triangle. More often they lie nearly in one plane, so that the outer wires are more remote from each other than either of them is from the middle wire. Again, it is common practice to mount a duplicate set of three conductors on the same towers, so as to provide two three-phase circuits in parallel and side by side. Under such conditions unbalanced voltages and currents may be looked for at the motor end of the lines.

The dissymmetry and unbalance can be eliminated theoretically by transposing the conductors systematically on the towers at regular intervals, but the compensation thus obtained is seldom complete in practice. Some residual unbalance is likely to be found. Moreover, the line impedance drop, although averaged alike with the aid of transpositions, is greater than it would be if the spacing were uniform and the duplicate three-phase circuit were removed. This is because the reactance of the wider loops is necessarily greater than that of the narrower loops, so that the average by transposition is greater than would be obtained with the three uniform narrow loops of equal uniform spacing. This increase of reactance in the actual construction tends to make the pressure regulation more troublesome over the three-phase system under varying loads.

The article by H. B. Dwight in this number points out an ingenious way of arranging the wires on the two sides of the tower so that the phases progress downward on one side and upward on the other. The disturbance due to the mutual influence of the two circuits is distinctly less in this case than if the phases progressed in the same direction on both sides of the

tower. With the aid of transposition on each side the average reactance and reactive drop will thus be reduced, and it becomes more easy to arrive at the balanced condition of emf. at both ends of the line. As the article points out, this plan does not involve any change in construction; it merely calls for a selection of the order of phases on each side of the tower. At most this can only involve changing the leads or switches at the ends of the lines. The plan will recommend itself to the attention of transmission engineers. It would be interesting to have a set of comparative reactance measurements made on some idle two-circuit, six-wire tower line, in the two conditions of Figs. 1 and 2, to see how closely the theory might be borne out.

Joint Valuations Deserve Wider Consideration

ANYTHING which promises to expedite the work of courts and commissions in these days of crowded dockets and complex responsibilities deserves the careful consideration of public administrators and utility executives. Among the problems accompanying the determination of rate bases and capitalization issues that of reaching a sound decision through engineering investigation is of primary importance, and in the past an enormous amount of time and money have been expended in technical battles across the witness stand, prolonged with all the ingenuity of able counsel to limits exhaustive of patience and resources on the part of the contending interests. Is there no better way than this?

An answer can probably be found, in some cases at least, in the joint appraisal by engineers representing the different interests. When the engineers concerned were engineers in reality and were actually striving to reach fair conclusions, with no attorneys present to befog the issue, surprising results have been obtained in a number of cases. To transfer the controversies and bickering over differences of opinion from the public witness stand to a round-table discussion is at times almost incredibly helpful. Experience shows that agreement frequently can be reached in a comparatively short time even upon such moot questions as allowances for overhead and intangibles—of which the Nashville appraisal of three years ago by Richey, Harris and Feustel, respectively representing the commission, city and utility company, still offers a classic example. There is little real reason why engineers in joint conference should not agree fully on matters of inventory and unit prices, allowing for a fair amount of give and take in order to reach identical figures on the latter. Such give and take "irons out" in the long run where fair-minded engineers are working on the case, but it is not easily possible of accomplishment after competitive appraisals are taken from the brief cases of counsel in the court room.

The engineering type of mind is well fitted to grapple with such issues as making allowances for inevitable omissions from inventory, construction wastages, incidentals, losses and contingencies in the form of percentages; allocating the cost (historic or reproductive) of plant devoted to different classes of service; estimating development costs during early years of operation; setting down proper reserves for renewals and replacements, and estimating the net cost of unamortized superseded property. These elements are bones of contention worn smooth and slippery with much legal handling in the past, and they are among the most fertile breeders of excessive delay and expenditure in judicial and regulative fields. The joint appraisal or conference valuation offers a way out that should be more commonly traversed, but such procedure is a waste of time and money unless the parties are in engineering earnest and are able to get away from the mere advocate's position in the necessary discussions.

The Tile Association Decree Should Not Stop Legitimate Statistical Work

WHEN the defendants in a suit instituted by the government under the Sherman act consent to the entry of a decree it is usually because some or all of them think that the charges made by the government are well founded or because they do not consider that the right to continue the activities on which the charges are based would be of sufficient value to warrant the expense and trouble involved in a trial of the issues. The Department of Justice in drafting a consent decree naturally wishes to make it as comprehensive as possible. The provisions of the decree therefore cover all activities of the defendants which might tend to effect their illegal purpose, even though some of such activities if taken alone would be unobjectionable. A decree based on a decision by the court after a trial of the issues would probably in many a case be not nearly so drastic as a consent decree drafted by the department.

A consent decree recently entered in the government's suit against the Tile Manufacturers' Credit Association and quoted in the ELECTRICAL WORLD, Dec. 8, page 1195, permits the defendants through their association to "receive and compile for transmission to any governmental agency such information and statistics as it may request as to the production, the stocks on hand and the prices of tiles," but restrains them "from distributing said information among themselves." This part of the decree has been the subject of much criticism, and it has also caused a great deal of confusion in the discussion of the legal questions involved in statistical work.

The Sherman act declares every contract, combination or conspiracy in restraint of trade or commerce to be illegal. It is very hard to see how an exchange of information as to production, shipments and stocks on hand can result in any restraint of trade or commerce, where such an exchange is made only for the purpose of giving to those receiving the information facts of great importance in the conduct of their business, on which they may individually base their judgment in determining their own policies. To add to the information so exchanged information as to prices creates an entirely different situation and one to which an illegal purpose may readily be imputed. The prohibitions contained in the Sherman act and the Federal Trade Commission act are general. One prohibits monopoly and restraint, and the other unfair methods of competition. Neither attempts to define the cases which fall within its provisions. The facts of a given case can best be tested under the general provisions of these two laws by the use not alone of knowledge of the decisions but of common sense and good conscience. Much trouble has been occasioned by attempts to do indirectly what has been forbidden by the courts if done directly.

The courts have in no case said that all statistical work which includes "production" and "stock on hand"

is bad, and there is nothing even in the consent decree mentioned above to lead one to believe that that will be the rule. The electrical industry is very much in need of reliable statistics, and after all that has been said about the Tile decree, both before and since its publication, it is reassuring to find that there is nothing fundamental in it which should interfere with the exchange of statistical information of a proper character.

A Plant That Is Sanely Different

ALTHOUGH the 400-pound-pressure generating station of the Public Service Company of Northern Illinois at Waukegan, described elsewhere in this issue, does not represent a big step forward in steam practice, it is one of the conservative forerunners of higher pressures. It also affords another example of the tendency of the operating companies to reinforce their systems at strategic points with large stations rather than to retain smaller, less economical plants at more frequent intervals. The station is interesting as indicating what the designers consider essential in a plant which will ultimately tie in with a number of other plants around Chicago through a 132-kv. line and which some day in the near future may exchange energy with the concentrated system of the Commonwealth Edison Company through 132-kv. underground cables, if experiments with cables which are reported to be planned prove satisfactory. Although 250,000 kw. is the ultimate capacity contemplated now, the company does not plan to limit the Waukegan station to this size if future developments warrant enlargement. Fortunately, if the company desires to make any enlargement, there will be plenty of condensing water. The size of the first unit is smaller than might be expected for a plant with an ultimate rating of 250,000 kw., but it was the maximum which the company considered justified at this time by the load available.

Although an advance has been made in steam pressure, no radical changes have been made in the boilers and piping. The figures of 11.2 cubic feet of furnace volume per square foot of grate surface and 3.27 square feet of boiler heating surface per square foot of furnace volume are interesting as indicating the designer's opinions of the proper relations between grate surface, furnace volume and boiler heating surface in this specific case.

As in a number of other new stations, the main turbines are bled for feed-water heating. The auxiliary exhaust is used to heat the make-up water only. Exhaust from the steam-ejector air evacuators is utilized in heating the main condensate prior to its entrance to the feed-water heaters.

Very few steam-driven auxiliaries are used in the plant, and alternating-current drive is used exclusively for all equipment which is not steam-driven. Even the stokers which require fine speed adjustment are driven by alternating-current motors of the wound-rotor types, forty speed adjustments being obtainable with ten points on the controller and the use of a four-speed gear box. This indicates a sincere belief of the company in the applicability of alternating-current motors for work to which direct-current drive has heretofore been considered better adapted.

Simplicity marks the electrical as well as the mechanical construction of the plant, the company's belief being that many provisions which have been made in the past to take care of emergencies have not been justified by experience. For example, there is no emergency drive for stokers, and induced-draft and forced-draft fans and a reserve exciter will not be provided. It is hardly expected, judging from experience, that the reserve capacity in the shaft-driven exciters will ever be needed for exciting other units, but this precaution will be taken by means of an emergency excitation bus.

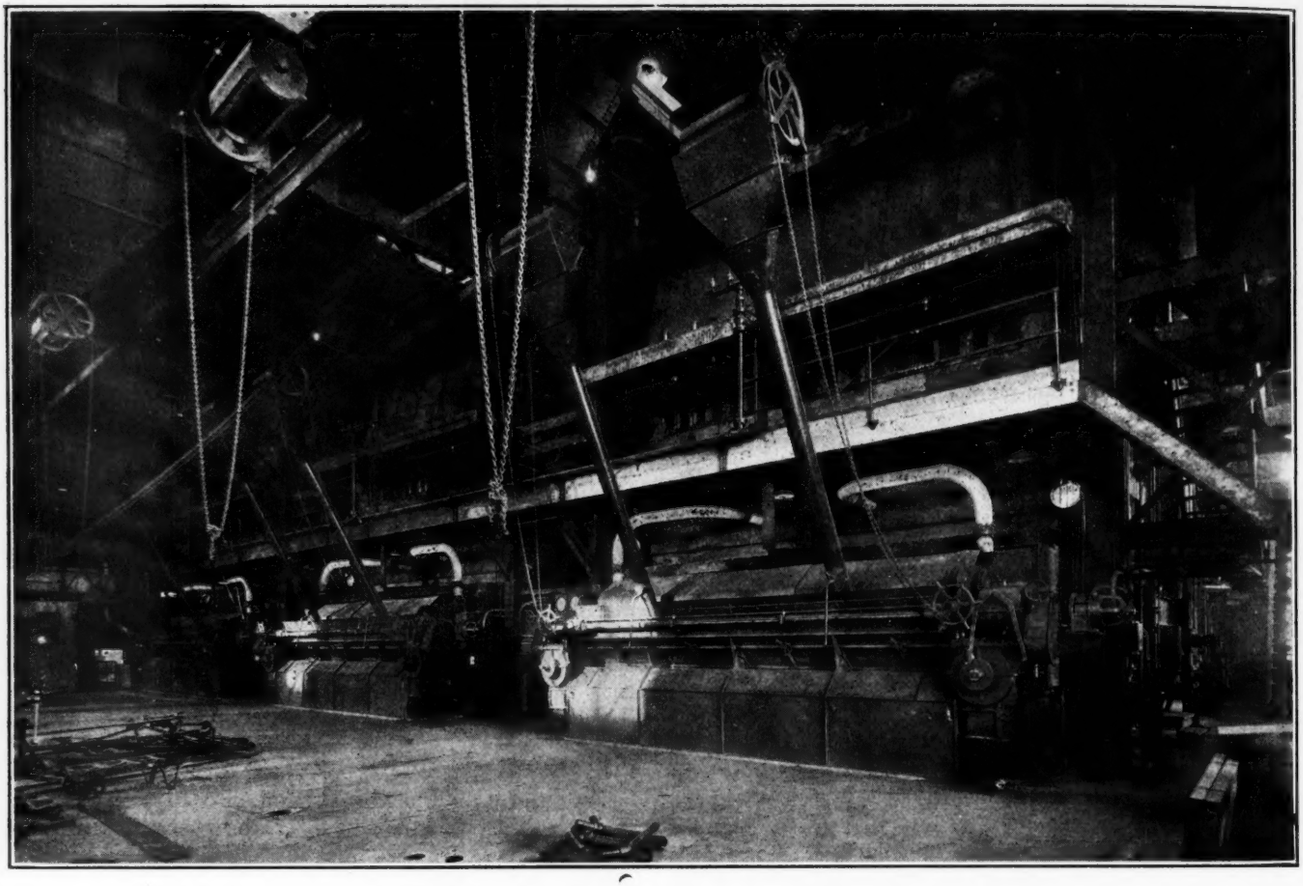
By electrically interlocking the oil circuit breaker which shunts the bus reactors with the generator circuit breaker in an adjacent bus, all the advantages of bus reactors are retained without having the disadvantage of reactance between bus sections when they are energized from only one generator. Reactors have been usd extensively in both the 12,000-volt feeders and the auxiliary service circuits to guard against faults close to the bus. It may be surprising that no supplementary supply of energy for auxiliary service is afforded, but the company feels that, with the station tied in by so many lines with other sources of energy and with the provision for energizing the auxiliary transformers from any bus, if necessary, there is no need of a duplicate source of energy in the station. In the 132-kv. switching structure advantage has been taken of the economy of single-bushing grade-insulation transformers.

In general, while the station embodies no radical features, it well shows how a progressive company is keeping abreast of the times by combining new ideas in a conservative way.

A Voluntary Study and Research Association

THERE are resident in Washington, D. C., a large number of men who are engaged in studying human problems, both within the federal offices and in privately controlled agencies. We are told that "some two years ago a number of these men established a university center for research. It is a voluntary association of scholars organized in a self-governing body called the Board of Research Advisers. Each of these men has agreed to give without charge individual aid to properly qualified advanced students in history, political science, international law, economics, statistics and education. Each of the members of the board knows what specific problems are pressing for solution in his special line of work and how each solution will help in solving national issues. Each is familiar both with the rich reservoirs of research material available in Washington and with the methods of securing access to this material. Any assistance they can give in promoting sound research in their special field of study will be gladly given."

In this mercenary and hurried age the foregoing item deserves more than a passing notice. Here is a group of underpaid scholars who realize the intangible values in life clearly enough to give of the fullness of their knowledge to those who thirst after it. Their example, it may surely be hoped, will be followed by specialists in physical sciences and in various branches of engineering in industrial centers. With the example of the Washington group before them, the excuse of "being too busy even to think of it" will not hold water; and in industrial centers no more than in Washington have dealings with inanimate nature and considerations of dollars and cents dulled the aspiration to help fellow beings.

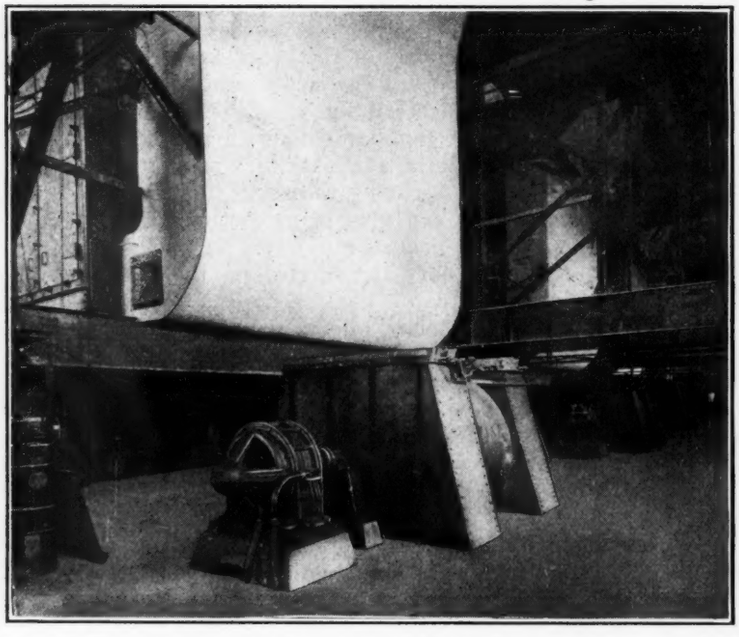


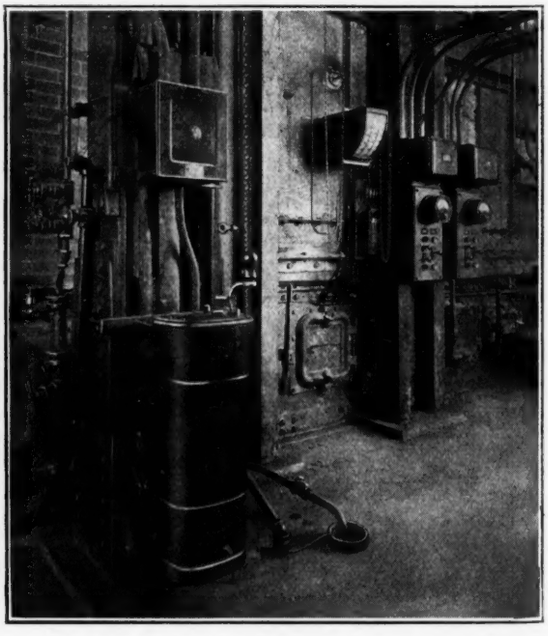
The 400-Lb. Boiler Room in Waukegan Station

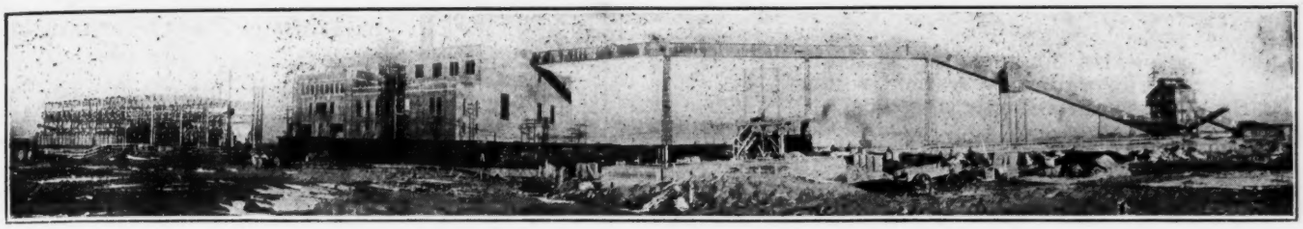
Upper View: Three 14,086 sq.ft. boilers are equipped with forced-draft and chain-grate stokers driven by wound-rotor induction motors. Steam-air flow gages are located over the aisles between the boilers and instruments are located on the side of each boiler above the stoker controller. A four-speed gear box is placed between the stoker motor and the stoker.

Lower Left: View of forced-draft fans and up-takes from the economizers. The forced-draft fan controls are at the left of each unit and are remotely controlled from the boiler front. The induced-draft fans are also remotely controlled and are placed on elevated platforms between the economizer up-takes and the breeching leading to the stack. There are speed and breaker control.

Lower Right: The boiler-room instruments and control are located for convenient operation. The forced-draft gage, the draft-gage on each of the five furnace zones and the draft gage on the up-take are placed on the side of the boiler wall. An ammeter is located above the stoker controller for determining the current used in the stoker motor circuit.







Waukegan 400-Lb. Plant Operating

High Pressure a Feature of the New Generating Station on System of Public Service Company of Northern Illinois—Ultimate Rating May Be 250,000 Kw. or More—Mechanical and Electrical Features

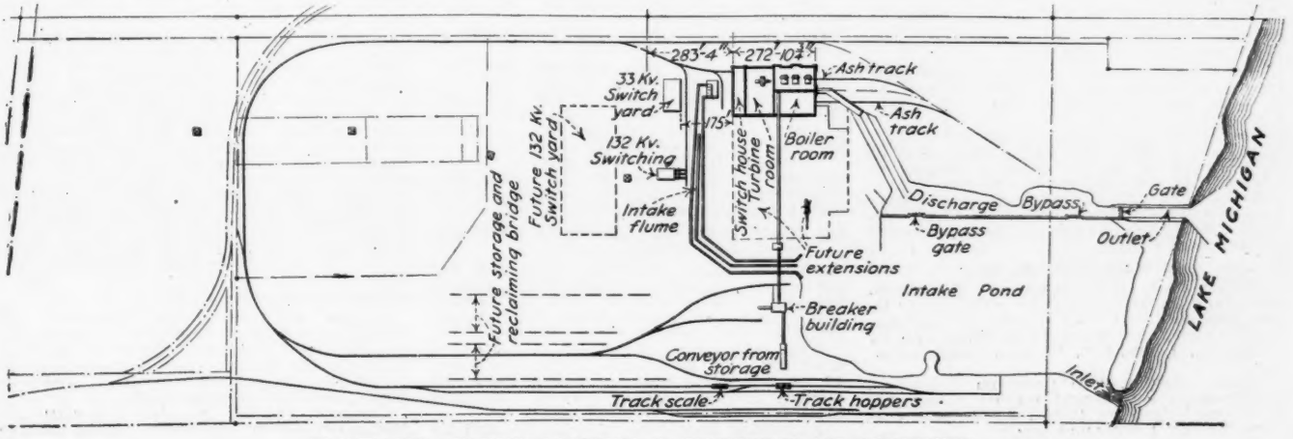
THE generating station of the Public Service Company of Northern Illinois which has recently been put in operation at Waukegan, Ill., about 38 miles north of Chicago, is not only interesting because of the steam pressure which has been adopted and certain features incorporated in the construction of the station, such as the universal use of alternating-current motors, but also because of the fact that this station was designed so that it can eventually be tied in by 132,000-volt loop lines with other stations of the Public Service Company of Northern Illinois at points west and south of Chicago. This plant was erected and placed in service thirteen months and eleven days after breaking ground.

Although only one 25,000-kw. unit and corresponding equipment have been installed so far, the building for two units has been completed and the station will ultimately house 250,000 kw. in equipment. The boilers are designed for 400-lb. steam pressure and have interdeck superheaters and alternating-current stoker drives. Most of the steam for feed-water heating is bled from the main prime mover, steam auxiliaries being used for only two-thirds of the feed-water pumps, for the boiler washer and fire pump and one of the service pumps. All other auxiliaries are electrically driven. Among the features of the electrical equipment are the shaft-driven exciters, the provision for automatically short-circuiting the bus-sectionalizing reactors under certain conditions, the use of reactors in the 12,000-volt feeders, the employment of conservator-type transformers with graded insulation and single bushings, the disposition of cable terminals in the switch house with grounding disconnecting switches and pilot lamps, a rather unusual arrangement of the auxiliary bus-and-switch structure, and the particularly convenient and flexible auxiliary-circuit control.

The Public Service Company of Northern Illinois,

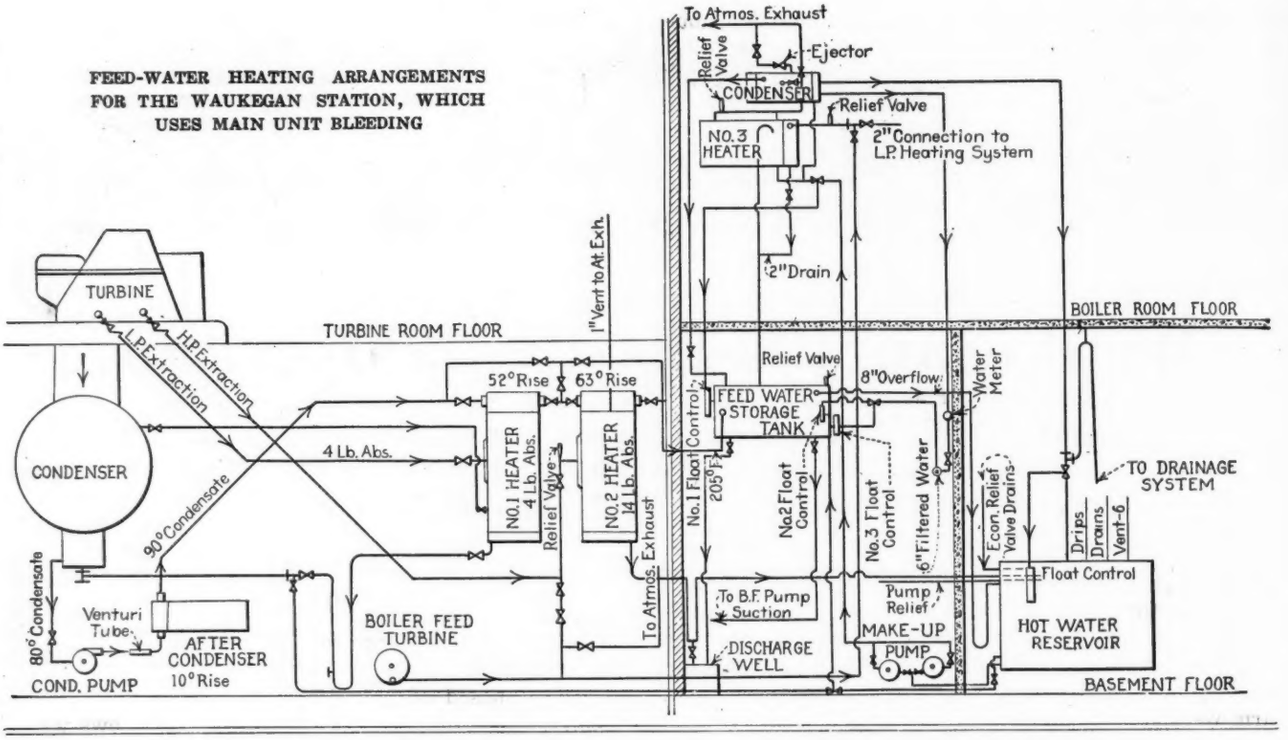
Some Facts About the Public Service Company of Northern Illinois

ON DECEMBER 1, 1923, the Public Service Company of Northern Illinois was serving approximately 156,000 customers with electric light and power, these customers being distributed through 195 cities and towns in fifteen counties having an area of 6,000 square miles in round figures. The number of customers increased about 17 per cent in 1923. To serve them 350,000,000 kw.-hr. of energy was generated in 1923 with an average coal consumption of 2.44 lb. per kilowatt-hour, or one-tenth the unit consumption in 1903 and about one-half that in 1913. The connected load on December 1 was 295,000 kw., and the maximum demand during the previous eleven months was 108,000 kw. Some idea of the equipment required to transmit the energy is given by the fact that more than 150,000 poles, 11,000 transformers and 156,000 meters were in use at the end of 1923, besides the underground system. Nineteen thousand different individuals hold securities of the company.



PLANT SITE, SHOWING LOCATION OF STRUCTURES AND EQUIPMENT

FEED-WATER HEATING ARRANGEMENTS FOR THE WAUKEGAN STATION, WHICH USES MAIN UNIT BLEEDING



Mechanical and Electrical Equipment Used in Waukegan Station

General:

Boiler room for six boilers—137 ft. x 155 ft. 6 in.

Turbine room for two units—96 ft. x 155 ft. 6 in.

Coal Handling:

To and from storage, 20-ton Browning locomotive crane rated at 140 tons per hour; from cars to bunkers, 140-ton-per-hour belt conveyor built by Koppers Company; track hopper to conveyor, duplex shaking feeder; feeder to breaker, 36-in. belt conveyor; from Bradford breaker to boiler house, series of three 24-in. belts, distribution to bunkers, 24-in. belt and tripper; refuse from breaker, 30-in. belt; total horsepower of conveyor drive (2,565 ft.), 72½ hp.; horsepower of breaker drive, 125 hp.

Stokers:

Three forced-draft, chain-grate Babcock & Wilcox stokers (one per boiler), 383 sq. ft. each; five air zones per stoker; Detrick radial-end arch, 21 ft. 6 in. wide; driven by 10-hp. adjustable-speed wound-rotor motor.

Boilers, Superheaters and Economizers:

Three 14,086-sq.ft. Babcock & Wilcox inclined-header boilers with 272 3½-in. tubes in upper deck and 1,156 2-in. tubes in lower deck; designed for 400 lb., 700 deg. total temperature. Furnace volume, 4,300 cu.ft., including space under arch.

Babcock & Wilcox superheater having 2,286 sq.ft. between upper and lower deck of boiler tubes; designed for 400 lb., 250 deg. superheat.

Duratex economizer (B. & W.) with 8,837 sq.ft. of heating surface.

Stack and Draft Equipment:

One brick-lined steel stack for three boilers supported on building steel work; 146 ft. 8 in. height above grate; 15 ft. inside diameter at top.

One double-inlet induced-draft fan (American Blower Company) per boiler; rated at 92,000 cu.ft. of air per minute; driven by 150-hp., 440-volt wound-rotor motor.

One double-inlet forced-draft fan (American Blower Company) rated at 60,000 cu. ft per minute; driven by a 75-hp., 440-volt wound-rotor motor.

Pumps, Feed-Water Heaters, Etc.:

Boiler feed, three Cameron 500-g.p.m. five-stage centrifugal pumps rated at 460 lb. per square inch; two driven by 250-hp., 2,275-r.p.m. Westinghouse turbines, one by a 350-hp., 1,750-r.p.m. General Electric motor.

House service, two Cameron 750-g.p.m. single-stage centrifugal pumps (head 135 ft.); one driven by 40-hp., 2,000-r.p.m. turbine, one by 1,800-r.p.m. motor.

Boiler wash and fire pump, one three-stage, 500-g.p.m. Cameron pump; turbine-driven.

Heaters, two straight-tube closed Ross extraction heaters with 1,480 sq.ft. each; one closed 220-sq.ft. Ross make-up heater.

Turbo-Generator, Exciter and Air Conditioner:

One 27,777-kva., 1,800-r.p.m., three-phase, 60-cycle, 12,000-volt Allis-Chalmers generator driven by single-cylinder reaction turbine operating at 350 lb., 240 deg. superheat, and bled at 4-lb. and 14-lb. stages for feed-water heating.

One 200-kw., 250-volt shaft-driven exciter.

One 75,000-cu.ft. per minute Carrier air conditioner.

Condenser and Auxiliaries:

One 32,000-sq.ft. horizontal Allis-Chalmers two-pass condenser with 1-in. (outside diameter) No. 18 gage tubes (70 per cent copper, 30 per cent zinc).

One 36-in. Allis-Chalmers 35,000-g.p.m. circulating pump driven by 300-hp. two-speed (390 and 435 r.p.m.) motor.

Two 600-g.p.m. two-stage Allis-Chalmers condensate pumps driven by 50-hp. motors.

Two two-stage Croll-Reynolds steam-jet evactors rated at 30 cu.ft. of free air each at 1 in. absolute.

Two stationary screens (Variety Fire Door Company).

Miscellaneous Mechanical Equipment:

Three 22-unit valve-in-head Diamond soot blowers.

One 225-cu.ft. self-contained Westinghouse air compressor.

One 100-ton four-motor Whiting turbine-room crane.

Feed-pump governors and drainage control; Northern feed-water regulators.

Consolidated safety valves; Edward blow-off valves, high-pressure gate valves and piping; Crane Sargol welded joints; Johns-Manville pipe covering.

Ellison and Bailey draft gages; Crosby indicating steam gages; Foxboro recording thermometers; Builders' feed-water meters; Bailey steam-air-flow meters.

Oil Circuit Breakers (All remote-controlled, solenoid-operated):

Six 2,000-amp., 12,000-volt type F-9, for generators and main transformers; twelve 500-amp., 12,000-volt type F-8 for feeders and auxiliary transformers; all Condit truck type in concrete compartments.

Two 600-amp., 33,000-volt FHKO-136-8C-S for main transformers; five 400-amp., 33,000-volt same type for 33-kv. lines; all General Electric outdoor type on individual steel framework.

Rupturing capacities of types F8 and F9 are 26,500 amp. and 40,000 amp. respectively at 15,000 volts; that of type FHKO is 7,500 amp. at 33,000 volts.

Seventeen 600-amp. type D-22 and two 2,000-amp. type Y-I Condit breakers for auxiliary circuits and transformers respectively, mounted on pipe framework.

Disconnecting Switches, etc.

Delta-Star single-pole, single-throw unit-type operated by hook stick.

All 33,000-volt "disconnects" on Jeffery-Dewitt insulators (three per stack) mounted on steel structure outdoors.

One 145,000-volt, 400-amp., three-pole, single-throw, vertical-break motor-operated switch with arcing horns (Railway & Industrial Engineering).

Transformers (Main):

Four (one spare) 12,000/33,000 volt, Y-connected, single-phase, 8,333-kva. oil-insulated water-cooled outdoor General Electric units.

Four (one spare) 12,000/132,000-volt, Y-connected, single-phase, 10,000-kva. oil-insulated, water-cooled, outdoor, single-bushing, graded-insulation Allis-Chalmers units.

Two (one spare) 13,200/480-volt, 1,800-kva. oil-insulated, water-cooled, three-phase, outdoor General Electric units for auxiliary service.

Two single-phase, 100-kva., 460/115-230-volt oil-insulated, self-cooled General Electric lighting transformers.

Current Transformers:

12,000-volt dry-type indoor Westinghouse units.—Nine through-type 2,000/5-amp. units with insulating bushings for generators; six through-type 1,500/5-amp. units with insulating bushings for 12/33-kv. transformers; three through-type 3,000-1,500/5-amp. units with insulating bushings for 12/132-kv. transformers; twelve 400/5-amp. type KB units for 12-kv. feeders; six 100/5-amp. type KB units for auxiliary transformers; one 600/5-amp. type KB units for measuring ground current.

33,000-volt outdoor, oil-insulated Westinghouse type O-1 units—Three 300-600/5-amp. units for 12/33-kv. transformers; twelve 150-300/5-amp. units for 33-kv. lines; three 150-300/5 amp. units for transfer bus feed.

Potential Transformers:

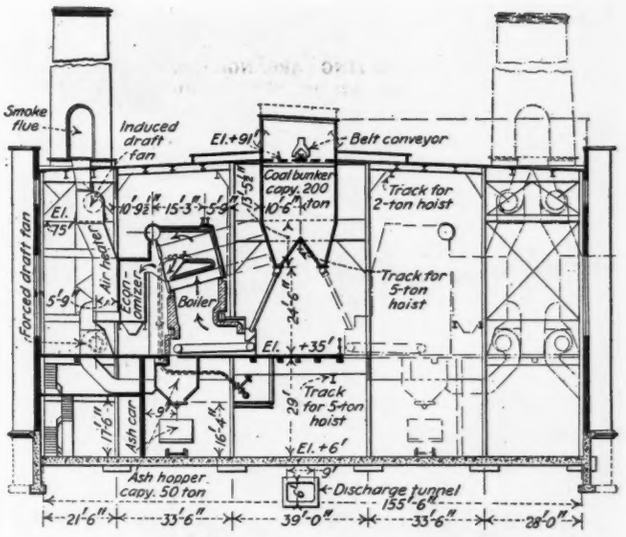
Indoor (13,200/110-volt, 200-watt oil-insulated).—four on 12-kv. buses (main and reserve) with resistors; two on generators; four on auxiliary transformers; three on 12/33-kv. transformer bank; two on 12/132-kv. transformer bank.

Outdoor (33,000/110-volt, 200-watt oil-insulated).—four on 33-kv. lines; one on transfer-bus feed; one on main 33-kv. bus.

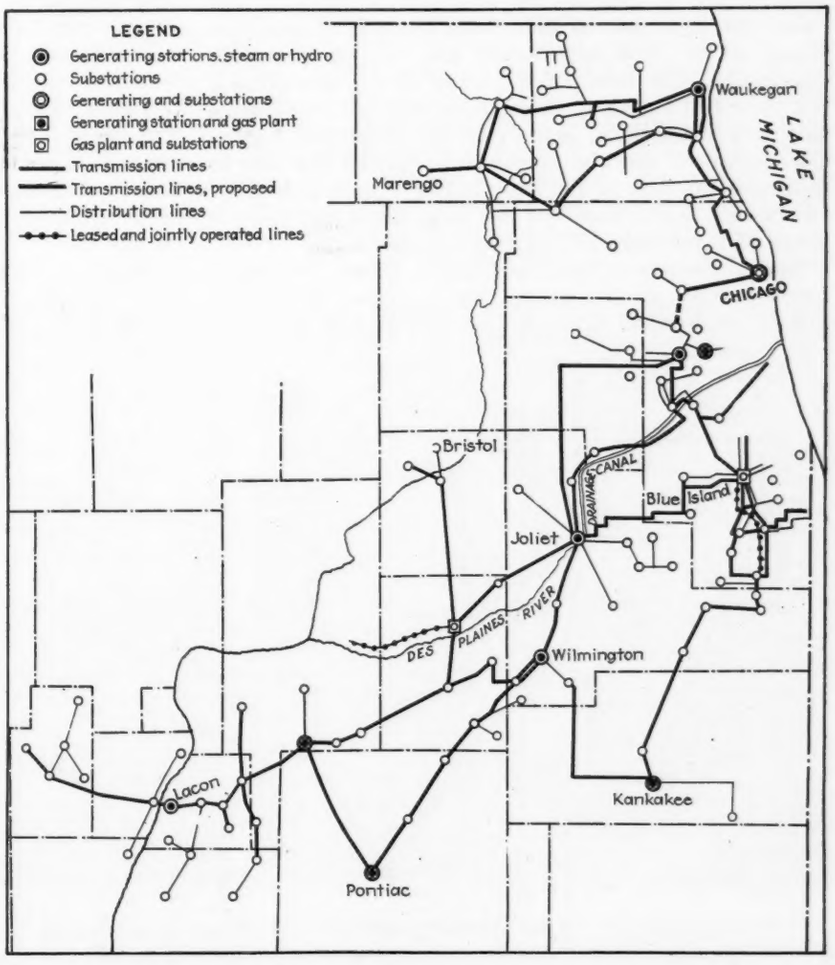
like other progressive utilities, is approximately doubling its output every five years, and there are prospects that the load will increase still more rapidly. To meet this increase in load and reinforce the North Shore district, the plant was built at Waukegan, on the shore of Lake Michigan, because that is the only place near Chicago on the North Shore convenient to an ample supply of both water and coal. Because of the prospect of tying this station in with others west and south of Chicago and a possible future high-capacity interconnection with the Commonwealth Edison Company, there is every prospect that it will become a base-load station, and it may ultimately exceed a rating of 250,000 kw. The rating of the station was not limited by the supply of condensing water available because Lake Michigan affords an unlimited supply. The size of the first unit, 25,000 kw., was determined largely by the present load factor and the generating capacity which could be justified from the outset. The seven units which will be required to complete the ultimate station will probably have a rating of 35,000 kw.

As indicated by the accompanying plat of the station site, water for boiler-feed and condensing purposes is taken from a 10-acre pond connecting with Lake Michigan. The intake to the station is separated from the rest of the pond by a diverting wall to prevent the warm water from the discharge flume recirculating and thus reducing the vacuum. In the winter a gate in the diverting wall can be opened so that the heat in the discharge water may be utilized so as to prevent the formation of ice in the intake system. The station is laid out in the customary manner, with the boiler house, turbine room and switch house next to one another in the order named, the boiler house being toward the side on which the water for boiler-feed and circulating purposes is obtained and the switch house toward the electrical side.

The boilers consist of two decks of inclined tubes with their lower ends connected to a 54-in. cross-drum. The lower deck is made up of 15-ft. 3¼-in. tubes eight tubes high and thirty-four rows wide, while the upper deck is composed of seventeen 2-in. tubes of the same length, seventeen tubes high and sixty-eight rows wide. These relatively small tubes were used to provide a larger heating surface per unit of contained water. Incidentally by using smaller individual elements it was



CROSS-SECTION OF BOILER HOUSE
This constitutes only one-quarter of the ultimate plant.



SYSTEM OF THE PUBLIC SERVICE COMPANY OF NORTHERN ILLINOIS

Lightning Arresters or Surge Arresters:
12-kv. three-stack oxide-film General Electric unit on generator leads, 33-kv. four-stack oxide-film outdoor-type General Electric units, one on each 33-kv. line and on 33-kv. transformer bank, 132-kv. four-stack oxide-film General Electric unit on 132-kv. line.

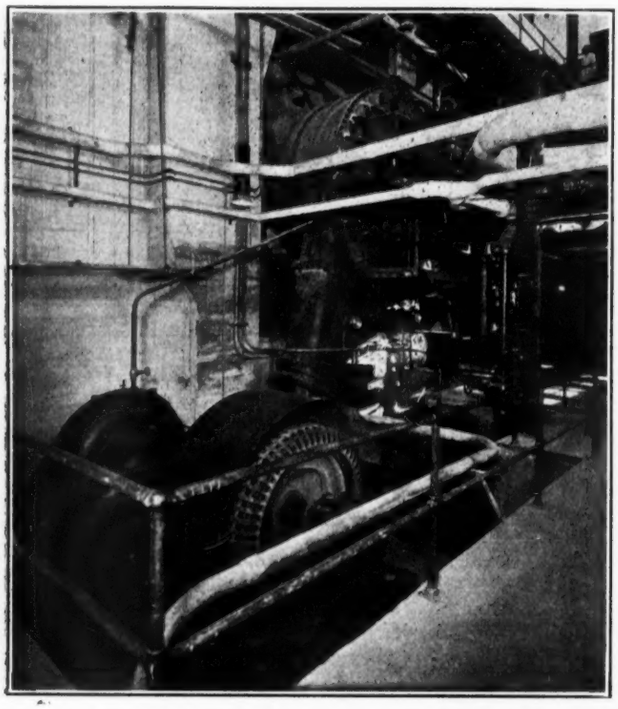
Reactors:
400-amp., 111-kva., single-phase type CLS cast-in-concrete indoor-type 3 per cent reactors with resistors in each 12-kv. feeder and circuits to auxiliary transformers.

Motor-Generator and Control Battery:
One 25-kw., 170-volt Westinghouse generator driven by 40-hp., 440-volt, three-phase, 60-cycle motor; fifty-six-cell, 125-volt, 80-320-amp. (8-hour and 1-hour rates respectively), type F-17 Electric Storage Battery Company's set.

Switchboard and Instruments:
Except for voltage regulating equipment and temperature indicator for 12/33-kv. transformers, furnished by General Electric Company, all switchboards including instruments were furnished by Westinghouse Electric & Manufacturing Company.

Lighting Feeder Regulator:
11-kva., 480-volt with 10 per cent buck-and-boost self-cooled, oil-immersed with control on case (Westinghouse).

Bus Supports, Safety Switches, Cable, etc.
12-kv. bus supports, unit type (Delta-Star), group-control type DF safety switches (V. V. Fittings Company).
Cable, Safety Insulated Wire & Cable Company.
Annunciator for switchboard, Holtzer-Cabot.



ONE END OF 35,000-SQ.FT. CONDENSER AND CIRCULATING PUMP

possible to use metal thicknesses no greater than, if as great as, that of the larger elements used in the construction of boilers for ordinary pressures. The tubes are arranged so that there are access lanes between all of them horizontally and in two directions diagonally. The tubes of the lower section are exposed for their full length to the radiant heat of the furnace, this part of the boiler being constructed without baffles. On account of the high superheat required and also to minimize the size of the superheater it is installed between the 3¾-in. tubes and the 2-in. tubes and is composed of three rows of 2-in. superheater loops.

The gases pass from the furnace across the entire lower section of the boiler, thence across the superheater and upward through the front part of the upper deck of boiler tubes, then down through the back section.

With the fuel to be burned (11,000 B.t.u. Southern Illinois coal containing 11 per cent ash) and at the capacities that will be developed, some tendency toward the formation of slag in the tubes of the lower section was expected, but none has occurred despite the fact that the boilers have been operated up to 340 per cent of rating. However, provision is made for the removal of any slag which does form through special doors below the uptake headers and also through rear doors. The superheater has 2,286 sq.ft. of surface, and the boiler is designed for a normal output of 100,000 lb. of steam and a maximum of 150,000 lb.

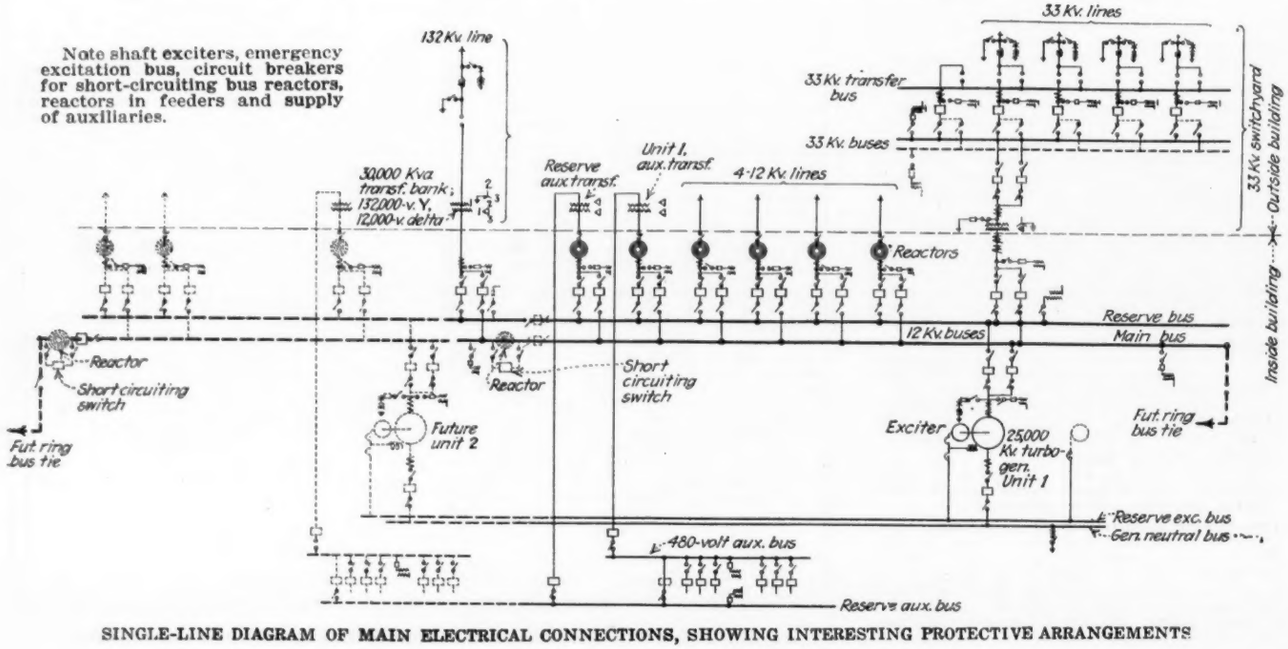
BOILER EQUIPMENT

The boilers, which are set with the middle point of the lowest tubes 16 ft. 8 in. above the grates, are fired with Babcock & Wilcox forced-blast chain-grate stokers, set under the high end of the boiler tubes. The stokers are 21 ft. wide by 18 ft. 3 in. long, giving a grate surface of 383 sq.ft. and a ratio of grate to boiler-heating surface of approximately one to thirty-seven. The chain grates are equipped with side-wall and bridge-wall wrought-steel water boxes connected to the circulation system of the boiler. B. & W. steel-tube counterflow economizers are placed at the rear of the boiler setting with the tubes transverse to the flow of the gases.

Each economizer is built in thirty-six horizontal sections, each containing twenty 2-in. tubes, 20 ft. 10 in. long, connecting with 7¼-in.-square wrought-steel economizer headers. Feed water enters the lower header at one side of the economizer and passes through a single row of tubes to the corresponding header on the other side. From this header the feed passes through a second row of tubes to the second header on the feed inlet side of the economizer and in a similar manner through all sections and series from the bottom to the top.

Space is provided for air preheaters, but none has been installed so far.

One steel stack having a diameter of 15 ft. at the

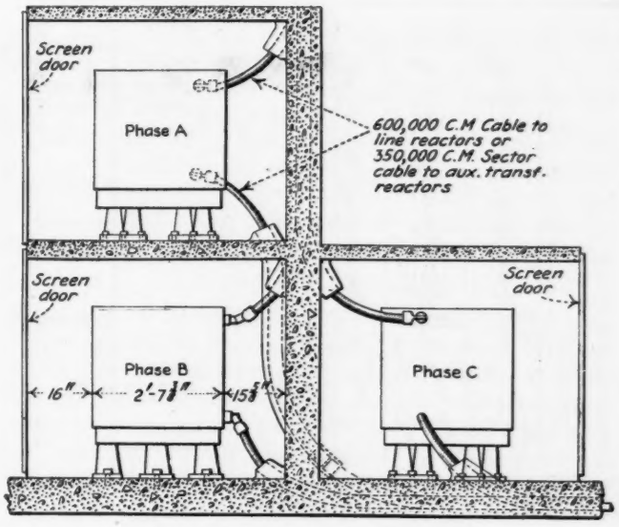


SINGLE-LINE DIAGRAM OF MAIN ELECTRICAL CONNECTIONS, SHOWING INTERESTING PROTECTIVE ARRANGEMENTS

top serves three boilers and extends 150 ft. above the boiler-room floor, or about 90 ft. above the roof. The stack is lined with brick the entire height; the breeching is lined with "Gunite." One forced-draft fan and one induced-draft fan are provided for each boiler, the former being on the boiler-room floor back of the economizers and the latter between the boiler uptake and the breeching. The engineers saw no need of cross-connecting the forced-draft ducts or providing for mechanical interconnection of the fans in emergencies, since 50 per cent of the full boiler rating can be obtained without any forced draft at all. Neither are the induced-draft fans provided with any emergency mechanical interconnection. Adjustable-speed wound-rotor alternating-current induction motors are employed for driving the forced-draft and induced-draft fans as well as the stokers. With ten points on the controller and four speeds provided by a gear box between the motor and the belt driving the stoker, forty speeds are obtainable. These provisions for speed adjustment permit a speed range from 2 in. per minute to 14 in. per minute for the chain grates. Forty per cent adjustment in speed is obtainable for the fans.

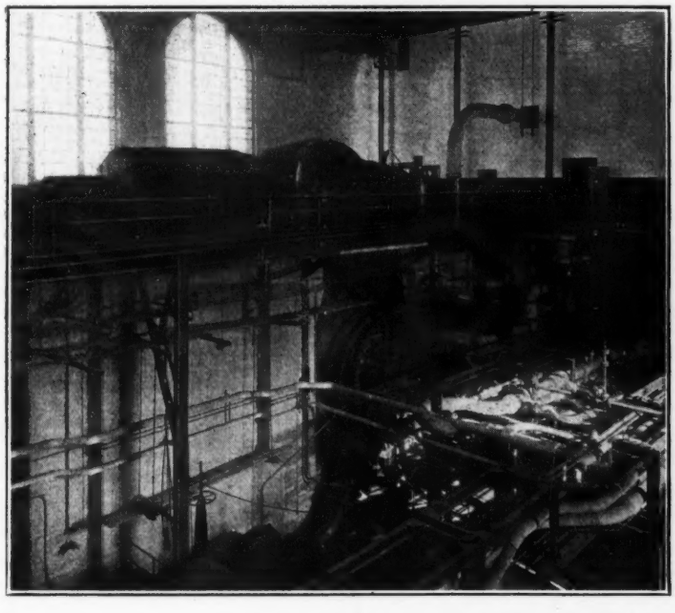
A double-gate ashpit having a capacity of 55 cu.yd., or twenty-four hours' storage, is provided under each furnace. The ash pits are lined with firebrick and equipped with gates having gutters which prevent dripping. The ashes may be dumped into standard railroad cars running along tracks in the basement. The unit system of steam piping is employed in which one header runs along each row of three boilers, connecting with the turbine throttle at one end and with pipes leading to the superheater outlets at each boiler. Welded piping with welded joints and steel fittings are employed throughout. Remote-control, motor-operated valves are provided in the leads from each boiler. A hydraulically operated valve is provided between the steam head and separator, pressure for operating it being obtained from the boiler-feed line.

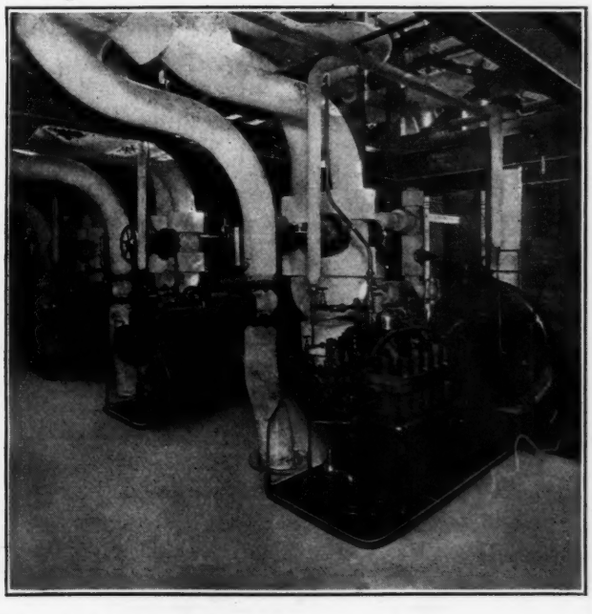
Coal is received from the Southern Illinois fields entirely by railroad and is either stored in the open (there being accommodations for 250,000 tons to 300,000 tons) by locomotive cranes or delivered to track hoppers. The locomotive cranes are used for reclaiming coal from storage. Track scales are provided to weigh all incoming coal. From the track hoppers a single-belt conveyor carries the coal to a 150-ton breaker, which will be adequate for crushing all the coal required when four units of the plant are operating. Eventually two breakers will be required when eight units are installed. The breaker is outside the boundary of the ultimate station and is connected by an 18-deg. inclined rubber-belt conveyor with an elevated horizontal conveyor running along one end of the boiler room at right angles to the boiler-firing aisles. This conveyor discharges onto cross-belts over each row of bunkers, trips being provided so that the belt can be dumped over any boiler. A bunker with two hoppers is provided for each



FEEDER-REACTOR ARRANGEMENT

The reactors were arranged in this way to minimize height of the room, the length of the building having been determined by other considerations.





ARRANGEMENT OF TURBINE-ROOM EQUIPMENT AND BOILER FEED PUMPS

Below at the left may be seen the circulating pump and motor. Under the horizontal piping on the condenser floor are the boiler-feed and service pumps. In the background under the turbine floor may be seen two of the closed feed-water heaters. At right, view of two turbine-driven and one motor-driven feed pumps located in the turbine room.

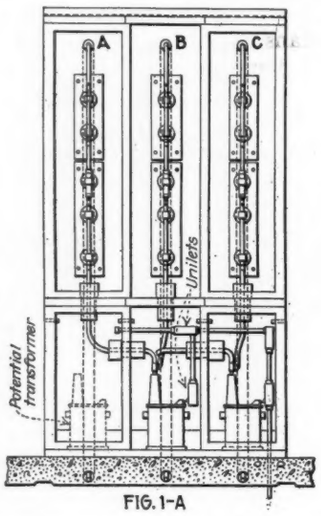


FIG. 1-A

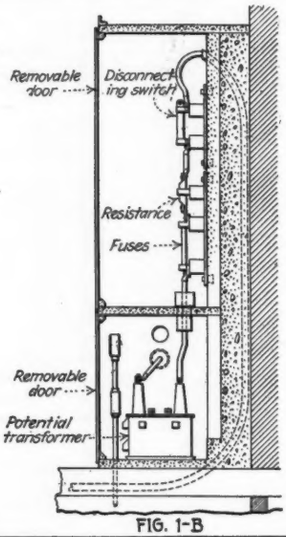


FIG. 1-B

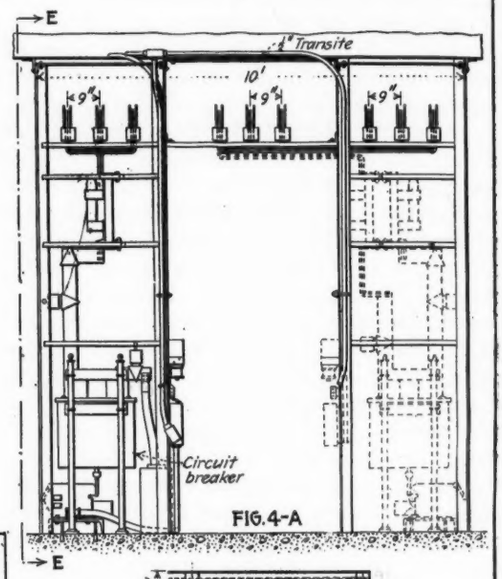


FIG. 4-A

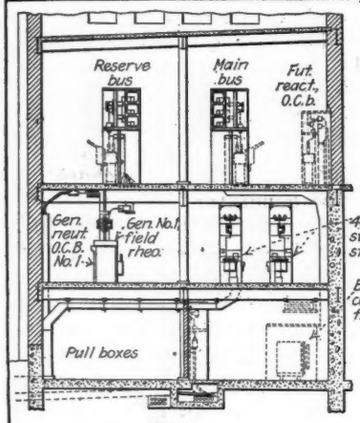


FIG. 2

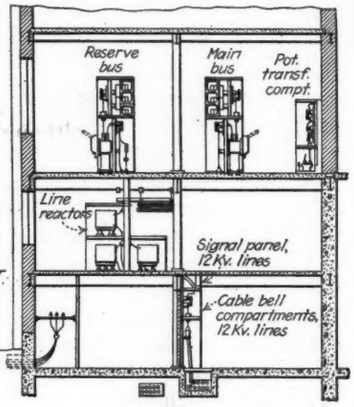


FIG. 3

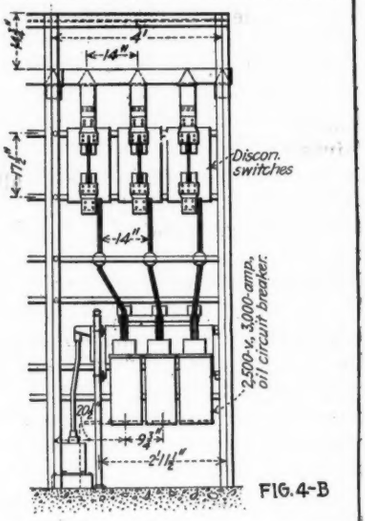


FIG. 4-B

Electrical Design Details

Figs. 1A and 1B. Elevation and section of potential transformer compartments. Figs. 2 and 3. Bus and line sections through switchhouse. Figs. 4A and 4B. Section and elevation of auxiliary service bus mounting. Figs. 5A, 5B and 5C. East elevation section and west elevation of main bus.

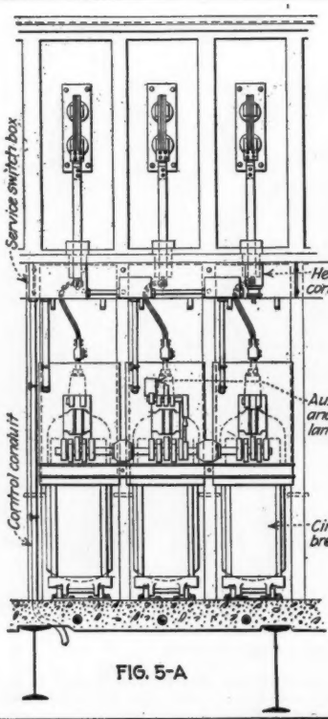


FIG. 5-A

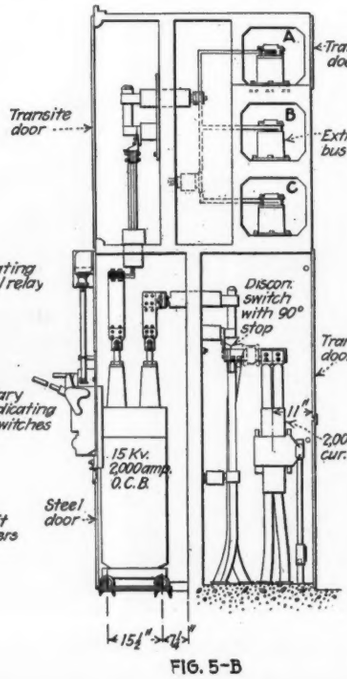


FIG. 5-B

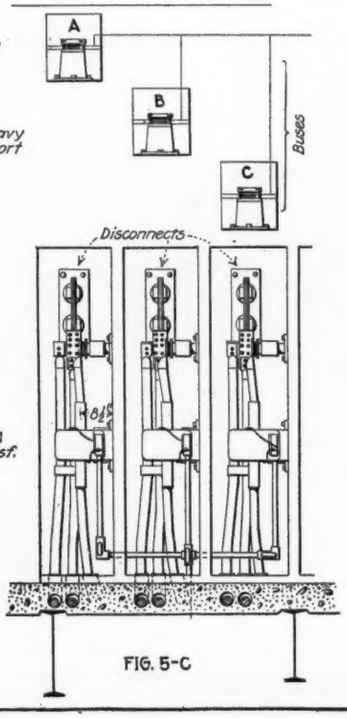


FIG. 5-C

stoker, and each hopper is equipped with a movable spout with a chain-controlled gate. Bunker capacity of 175 tons is provided for each boiler, or the equivalent of twenty-four hours' coal supply.

TREATED WATER USED

Filters and chemical water softeners with a capacity of 7,500 gal. per hour are provided for the three boilers installed to reduce the hardness of the feed water, which is taken from the circulating-water intake tunnel.

The method of handling the feed water is indicated by the accompanying schematic drawing. Condensate is drawn from the hot well of the main condenser and pumped through an "after condenser" (heated by the exhaust from steam-jet air ejectors on the main condenser) and through two closed feed-water heaters to the feed-water storage tank. From this the boiler-feed pumps pump it to the economizers. These two closed heaters are heated with steam bled from two stages of the main turbine. The feed-water storage tank is equipped with three float controls. The first, which is the only one which operates under normal conditions, admits make-up water through a third closed heater heated by the exhaust from the steam-driven auxiliaries. Connected with the steam space of this heater are a condenser and a small steam-jet air ejector, which maintain a partial vacuum on the auxiliaries, though their chief purpose is to utilize all of the exhaust steam from the auxiliaries. If the normal supply of make-up water is interrupted, the second float on the feed-water tank permits water to flow directly from a hot-water reservoir (which collects drips, drains, etc.) to the hot well of the main condenser, whence it goes through the normal path of condensate outlined previously. As a third supply of make-up water in case the other two fail, the third float on the feed-water tank admits cold service water directly to the feed-water system.

The boiler-feed pumps draw their supply through main or auxiliary suction lines and pump through main or auxiliary supply lines to water-level regulators on each boiler. Venturi meters are provided in each boiler-feed line. For each group of three boilers there are three 500-gal. feed pumps, two of them steam-driven and one motor-driven.

Besides the feed-water pumps there are only two steam-driven auxiliaries per unit—one a boiler wash and fire pump rated at 500 gal. per minute, and one a service pump rated at 750 gal. per minute. All other auxiliaries are motor-driven. The turbine auxiliaries include one 32,000-gal. circulating pump driven by a two-speed wound-rotor alternating-current motor, two hot-well pumps and two steam ejectors with two jets each.

The one turbine which is installed is rated at 25,000 kw. and is designed to operate at 350 lb. pressure and 675 deg. total temperature. As mentioned before, it is bled at two points for feed-water heating. Spring-supported beneath it is a two-pass, 35,000-sq.ft. surface condenser with a divided water box.

PANELBOARD EQUIPMENT

Instrument boards are provided at each boiler and turbine. On the boiler-room floor in front of each boiler is a panel supporting the following instruments: Forced-draft gage, draft gage on each of the five furnace zones, draft gage on the uptake, ammeters on auxiliary motors and steam-flow air-flow indicators and recorders. Furnace-temperature indicators may be provided later. Control for the stoker motors and forced-draft and induced-draft fans is also installed on the boilers. Inlet and outlet temperature recorders are provided on the economizers.

Besides the usual instruments on the turbine control board there is a kilowatt meter indicating the power delivered by each turbine. A signal board at one end of the turbine room indicates the total load on the station.

ELECTRICAL LAYOUT

Simplicity without the sacrifice of reliability has been the guiding factor in the design of the electrical layout. The present generator is rated at 25,000 kw. (90 per cent power factor), 12,000 volts, 60 cycles, three-phase. Both terminals of each phase of the generator windings lead through differentially connected current transformers that operate balanced relays opening the generator oil circuit breaker, field switch and neutral oil circuit breaker in case of trouble inside the generator. Beyond the current transformers the generator leads which go to make up the neutral are joined and connected to the neutral bus through an oil circuit breaker. The bus in turn is grounded through a separate circuit breaker. The closed-circuit air-washing system is installed, although the ventilating air is allowed to discharge into the generator room at present. Because of the inherent reactance of the generator (15 to 17 per cent) it was not considered necessary to have generator reactors. Temperature indicators are connected with the generator, and the one which shows the highest temperature will be employed for determining the maximum load that the unit can carry. Instead of connecting static dischargers on the generator bus, as is usually done, they are connected directly to the generator leads on the bus side of the generator oil circuit breaker.

Shaft-driven exciters rated at 200 kw. and 250 volts are provided. These are large enough to excite two units. To permit emergency excitation an exciter bus will be installed when additional generators are provided which will permit utilizing the extra rating in any exciter for any generator. To regulate the voltage of the generator a contact-making voltmeter is employed which actuates a motor-operated field rheostat in the exciter field.

RING BUSES CONTEMPLATED

Main and auxiliary 12,000-volt buses are provided and will be closed into rings with single-conductor cables after additional generating units are installed. At that time bus-sectionalizing reactors will be installed between each generator and shunted by an oil circuit breaker electrically interlocked with the oil circuit breaker of the generator in one adjacent section, so that the reactor will be short-circuited when the corresponding generator is taken off the bus. This will make it possible to get all the protection for which the bus-sectionalizing reactors were installed and at the same time will permit cutting out all bus reactance except between bus sections which are energized by separate generators. Thus, if it is found desirable to serve feeders on adjacent buses from the same generator, the two buses may be operated as one from one generator without any intervening reactance, and reactance will be maintained only between the ends of this bus and adjacent buses served from other generators to be installed.

As shown by the accompanying line drawing, each

generator may be connected with its main or auxiliary bus by selector switches which are of the truck type.

Four 12,000-volt feeders and one auxiliary feeder will be served from each generator bus. In addition, there will be one reserve auxiliary feeder for each group of two generator buses. Reactors are provided in all feeders except those to the 12,000 kva./33,000-volt transformers and to the 12,000/132,000-volt transformers which are installed outside the plant and served by underground cable laid in fiber duct. Overload protection is provided on each feeder, although it may be possible to go to impedance-drop relays or something of the sort when the station becomes more extensively interconnected with other parts of the system.

TRANSMISSION AT 33,000 VOLTS

Most of the energy leaving this station at the present time is transmitted at 33,000 volts, although it cannot be said that this condition will exist when the ultimate station is completed. For the 33,000-volt service three 8,333-kw., 12,000/33,000-volt grounded "Y" single-phase transformers are provided with one reserve which can be readily connected in emergencies. These transformers, as well as all others used for power service, are of the water-cooled conservator type with differential protection and temperature as well as water indication and alarm.

The 33,000-volt bus consists of one main and one transfer bus; later there will be an auxiliary bus. The transfer bus is fed from the main bus in the same way as a feeder, and any 33,000-volt feeder can be connected therewith. Owing to the fact that the 12,000/33,000-volt transformers have sufficiently high internal reactance, it was not considered necessary to have reactors in the 33,000-volt line. Straight overload protection is provided, although it may be possible here again to use impedance-drop relays or some new development in relays as the system grows.

For transmission to Evanston and ultimately tying in with the other stations west and south of Chicago, one 30,000-kva. bank of 12,000/132,000-volt grounded "Y" transformers are provided with one reserve. These are of the single-bushing, graded-insulation, water-cooled conservator type with water and temperature alarm and indicators. Later there may be more 132,000-volt transformers, and space has been provided for them. Straight overload protection is provided for the lines and differential protection for the transformers.

Virtually all of the motor-driven auxiliaries in the station are operated at 480 volts. To provide this service 12,000/480-volt transformers are fed from the 12,000-volt bus the same as any feeder. No other source of supply was considered necessary for the auxiliaries, for it is expected that the buses can always be maintained energized because of the numerous interconnections with other parts of the system. Hence no interruption of auxiliaries due to failure of the supply is expected.

DESIGN OF SWITCH HOUSE

The switch house, which is next to the turbine room, is three stories high except at one end, where it is four stories high, and this fourth floor is devoted to offices. The third floor is on a level with the turbine room. One end of it is devoted to the operating room. When the station is completed this will be the center of the switch house. The remainder of the third floor is devoted to the 12,000-volt buses and to bus and line potential transformers. These transformers have current-limiting resistors connected in series with them in addition to the fuses.

On the second or mezzanine floor are the line reactors and the 480-volt auxiliary switch-and-bus structures, generator-field rheostats and static dischargers. Space is provided under the operating room for control of this auxiliary equipment.

The first floor is devoted to a 320-amp.-hr. (one-hour rate) control battery, space for the bus reactors and end-bell compartments for the 12,000-volt feeder. The end bells for the 12-kv. cables to the 12/33-kv. and 12/132-kv. transformer banks are in separate rooms. "Disconnects" are provided on all of these outgoing circuits with 90-deg. stops and grounding clips. When the "disconnect" is pulled open it will be stopped in the 90-deg. position unless the switch hook is put in the stop release and the "disconnect" pulled into the grounding clip for protection of linemen. This arrangement is thought to be unusually safe and has proved to be economical in operation.

In the operating room are a benchboard controlling the generators and auxiliaries, and vertical panels set back to back for controlling the 12,000-volt feeders, 33,000-volt and 132,000-volt transformers and lines, station lighting and exciters and batteries. An annunciator panel is provided to show the position of oil circuit breakers and indicate the overheating of any unit. The recording instruments and relays are mounted on the rear panels, and indicating instruments and switches which must be in view of the operator on the front panels. Test terminals are provided on the front of the panels at the bottom. These boards are made of ebony-asbestos wood.

AUXILIARY SERVICE

The auxiliary-service bus-and-switch structure is built of vertical T-irons and horizontal pipe supports, clamped thereto with U-bolts. This construction eliminates the threading of pipe on the job and affords a very rigid structure. The oil circuit breakers are set 90 deg. from the usual position to permit running their leads directly to the "disconnects" without 90-deg. turns in the leads.

All auxiliary-service oil circuit breakers are on the mezzanine floor of the switch house. The larger auxiliary motors, like the circulating pumps, boiler-feed pumps, fans, etc., have circuits running directly to them from the oil circuit breakers in the switch house. Their control stands are mounted near the motors or at some other convenient point. For example, the controls for the forced-draft and induced-draft fans are mounted on a boiler-room panel near the front of the corresponding boiler. At the control points are the speed-control and remote-control switches for operating the oil circuit breakers in the switch house.

Circuits for other auxiliary motors are grouped and run from the corresponding oil circuit breakers in the switch house to control centers in the turbine room, boiler room or breaker house, as the case may be. At these points are remote-control switches for the corresponding oil circuit breaker in the switch house and safety switches for the individual circuits. Starting compensators, of course, are placed near the motors or at other convenient points.

The mechanical and electrical layout was designed by Sargent & Lundy, and the station building was designed by H. V. Von Holst.

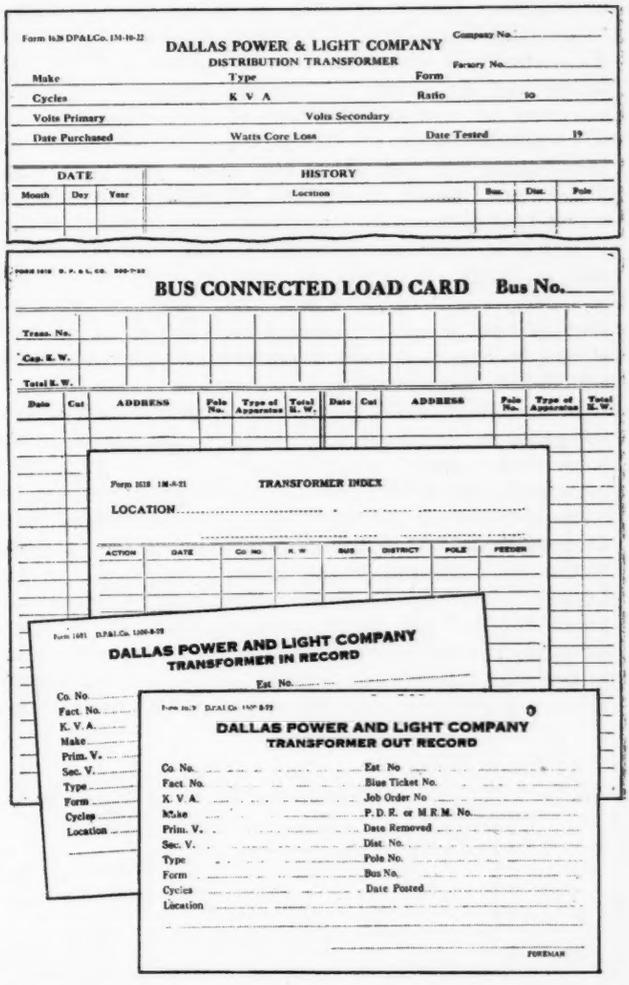
Transformer Maintenance Schedule

Details of Forms and Methods Used by the Dallas Power & Light Company—Replacement of Old Transformer Equipment Which Shows Excessive Losses

KEEPING everlastingly at the job is the secret of eliminating the trouble that can occur in distribution transformer installations. There are three things that can make the "keeping-after process" successful. The first is to keep a careful watch on the load imposed on the transformers by the constant change in customers' load taking place on any system. The second is to see that a transformer which is removed from the line for any reason never goes back until it is in first-class condition again. The third is to watch the transformers that for one reason or another are not shifted from their location for a considerable period of years. It is not an uncommon thing on many systems to find transformers that have been in service five, ten or even a longer period of years without ever having been looked at. Still another important matter to be looked out for is the one of increasing losses. There comes a time when the saving in lessened losses made by scrapping a transformer will be enough in a short period of time to pay for the new instrument.

The maintenance schedule of the Dallas Power & Light Company follows the transformer through its entire life, beginning with its purchase and entry on the history card. This is merely a record of the transformer and its location at various points on the system during its life. A load record from which the loading of the transformers is kept is maintained on the bus-connected-load card. An index card is used in connection with the load-record card. It is through the use of the records shown in the accompanying illustration that a constant check on the loads is maintained, and as the additions are entered it is possible to tell by inspection of the record whether changes in transformers are needed. The entire routine in handling transformers is shown in Fig. 1 on the next page.

The maintenance schedule calls for the bringing in of all transformers that are not shifted for other reasons and putting them through a thorough cleaning and repair routine as conditions make it appear necessary. All transformers that come into the storeroom for any reason in the regular course of operation are put through this routine and when put on the line again are as nearly in new condition as it is possible to place an old piece of equipment. One or two troublemen are kept continually inspecting transformers in service, particularly for blown fuses, broken bushings, signs of overheating and any troubles that indicate attention to be needed. All cases of blown fuses and apparent overheating are reported to the engineering department, and load tests are made by that department with a split-core transformer at the time of peak load to determine what the actual load conditions are. In case overloads are found, a study is made of the secondary bus involved, and such additional transformer capacity is installed as may be required. In cases where a transformer is burned out a careful study is made, not only to fix responsibility, but to check the effectiveness of protective devices. This general routine has served admirably in forestalling trouble because it reveals



GROUPS OF RECORD CARDS USED FOR TRANSFORMERS AFTER BEING PUT INTO SERVICE WHEN NEW

History card used by the Dallas Power & Light Company in its transformer record. The bus-connected-load card is used with distribution maps which show the circuits and on which the various buses are identified. The transformer "in-and-out" cards constitute a record of the movements of transformers. The "in" card is white and the "out" card is orange in color. The index card is a record of transformer installations.

transformer installations that need attention before trouble occurs, or in the case of failures reveals the cause of failure so that steps can be taken to prevent it in the future.

The company maintains a shop devoted to the repair and overhauling of transformers. Every transformer taken from the lines is brought into the shop and first tested for insulation. This is done by connecting one secondary lead to the case and then applying 8,000 volts (for 2,200-volt transformers) between primary and secondary for one minute. If it breaks down to the case or between windings, it is put in the junk class, since it has been found difficult and expensive to make repairs. The next test is for core loss. This test determines whether the transformer shall be retained

for service, and it is made with the wattmeter. The following general rule is used for determining whether the transformer shall be retained or discarded: "A transformer should be junked if the excess core loss in watts is greater than 93 per cent of the price in dollars of a new transformer of equal capacity."

The rule is based on an interest rate of 8 per cent, a transformer life of fifty years and a production cost of energy of 1 cent per kilowatt-hour. It is developed as follows: Use the formula $E = AT/R$ (Goldman's "Financial Engineering," Chapter III, page 31), where E = equity, A = annual cost of operation, T = term factor and R = rate of interest. Since E = equity = price of new transformer of high efficiency, and A = annual excess of cost of operation — excess core loss (watts) $\times$ 0.01 $\times$ 8,760 (hours per year), and T = term factor = 0.97868, therefore the price of a new transformer = (excess core loss [watts] $\times$ 0.01 $\times$ 8,760 $\times$ 0.97868) $\div$ (0.08 $\times$ 1,000), or excess core loss in watts = (price of new transformer $\times$ 0.08 $\times$ 1,000) $\div$ (0.01 $\times$ 8,760 $\times$ 0.97868) = 93.3 per cent of the price of a new transformer. The curve shown in Fig. 2 is used to answer the question in the actual test-room work.

If the transformer is to be retained in service, the next step is the removal of the core for cleaning and inspecting. Such minor repairs as are necessary, principally those to leads and bushings, are made. A large amount of trouble has been experienced with flashovers across certain types of primary terminal blocks on 2,200-volt transformers. Inasmuch as the 1,100-volt taps are not used, these terminal blocks are taken out and the leads cut straight through. Considerable trouble has been experienced with some types of bushings used on the primary leads of transformers. These are replaced with other types which fit and have been found by experience to be free of this trouble. The transformer is then placed in its case and returned to the storeroom ready for service. One operating trouble that has been very annoying is the siphoning of oil. Some relief is obtained by cutting the insulation off just before it enters the bushing on the inside of the case and reinsulating it with fiber. However, this does not stop the action entirely.

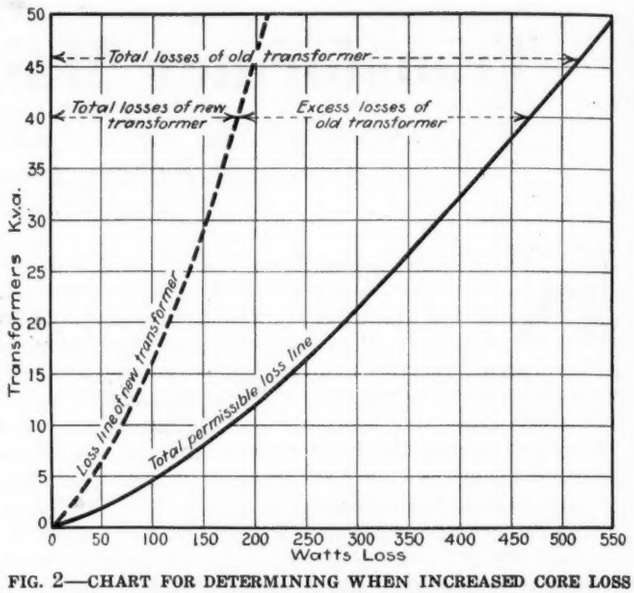


FIG. 2—CHART FOR DETERMINING WHEN INCREASED CORE LOSS DUE TO AGE JUSTIFIES TAKING TRANSFORMER OUT OF SERVICE AND SELLING OR SCRAPPING IT

The total permissible loss-line curve is based on transformer prices given in table below, and corresponding corrections should be made for variations in market prices and losses of new transformers in accordance with the following rule. An old transformer should be removed from continuous operation if the excess loss in watts is greater than 93 per cent of the price in dollars of a new transformer of equal capacity.

TRANSFORMER PRICES—DEC. 1, 1921

Capacity, Kva.	Price	Capacity, Kva.	Price
1.5	$36.70	15	$150.00
3	52.80	25	218.00
5	71.00	37.5	292.00
7.5	93.00	50	360.00
10	113.00		

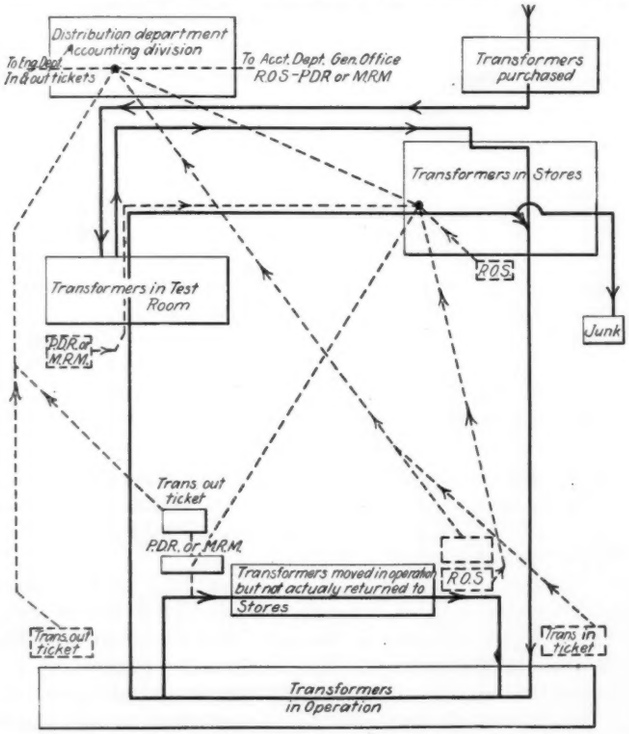


FIG. 1—PHYSICAL ROUTING OF TRANSFORMERS PURCHASED AND PUT IN SERVICE AND THE CORRESPONDING RECORD ROUTING

The initials "R. O. S.," "P. D. R.," "M. R. M.," refer to the original accounting records or memos showing the transformer movements as they occur. From these the permanent transformer records are made.

Before the shop was established it was customary to put all transformers which had apparently been burned in the scrap heap. In 1920 transformers worth $8,440 were sold as junk. In 1921, with the test and repair shop in operation, transformers worth $1,910 were lost. In twenty-one months ended with May this year, with 2,730 transformers in service, only thirty-nine were lost. Sixteen of those lost were due to overload, twelve to lightning, four played out on test, running without oil two, and improper connections two.

The transformer shop is an extremely simple affair. The test equipment for high-voltage consists of two 4,000-volt transformers connected in series and controlled on the low-voltage side from a panel made up of such parts as were available. The other test equipment comprises merely ordinary standard portable test instruments. The shop is arranged so that the transformers are unloaded from the trucks as they come into the storeroom yard and carried by a trolley-type hoist to the test table. From the test table they pass to the workbench, where the cleaning and overhauling is done, and thence out to the storage yard for reinstallation. They enter one door of the shop, pass around three sides and out another door without any unnecessary handling or moving backward. The trolley-hoist rail passes around the three sides of the room.

Reducing Inductance on Adjacent Transmission Circuits

Explanation of Arrangement of Conductors on Steel Towers by Which Inductance Is Materially Decreased

BY HERBERT BRISTOL DWIGHT
Canadian Westinghouse Company

THE choice of the phases to which each conductor should be connected when two transmission or distribution circuits are close together has a very important bearing on the inductance of the circuits. The usual arrangement of two circuits on one tower is shown in Fig. 2. But it is found that by choosing the proper arrangement of conductors, and without changing the mechanical design of the towers or changing the amount of the transposition or rotation of the circuits, the inductance of each circuit can be reduced by as much as 7 per cent when the two circuits are carrying equal loads. The arrangement for this result is shown in Fig. 1. With the same arrangement the greater part of the unbalance may be eliminated.

The arrangements suggested do not involve any expense, since they refer only to the phases to which the various conductors shall be connected, after the line is built. The design of the towers can be settled by mechanical considerations only.

The calculations are actually comparatively simple, though some of the expressions may appear at first glance to be complex. They are also easily applied to special cases other than those illustrated. The use of the letter j should not give an impression of complicated

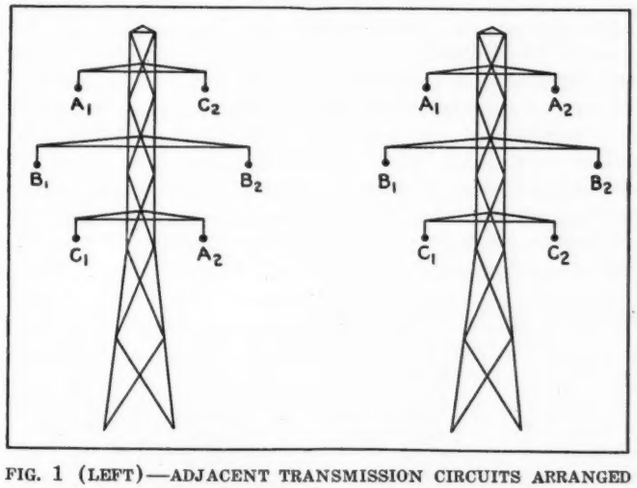


FIG. 1 (LEFT)—ADJACENT TRANSMISSION CIRCUITS ARRANGED OPPOSITELY. FIG. 2 (RIGHT)—ADJACENT TRANSMISSION CIRCUITS ARRANGED ALIKE

mathematics to electrical engineers, for it is used in a great many familiar calculations of alternating currents. As a matter of fact, about all there is to learn or remember about the letter j is that $j \times j = -1$.

When two circuits are carried on the same line of towers, they often have flat spacing: that is, the three conductors of a circuit lie in a plane, which usually is vertical or nearly so. When the conductors are loaded with ice, one conductor may lose its ice load on one span before the others, and when suspension insulators are used, they can allow a large vertical rise in that conductor, so that it is safer not to have two adjacent conductors placed one vertically above the other. Accordingly, one conductor is frequently offset somewhat.

It is not difficult to calculate the reactance drop in each conductor when the loads on the two circuits are equal, which is an average condition, and includes the case when the circuits are in parallel.

For Fig. 1, assuming $A_1B_1 = B_1C_1 = m$,
$A_1C_2 = 1.5m$,
and $B_1B_2 = 2.5m$,
there results: $A_1C_1 = 1.732m$,
$A_1A_2 = 2.29m$,
and $A_1B_2 = 2.18m$,

Then, according to results shown in the appendix to this article, letting the radius of the conductor be r:

E_a = reactance drop in $A_1 = j\,\frac{\omega 2I}{10^9}\,[\frac{1}{2} - \log_h 2.29mr + (0.5 - j0.866)\log_h (2.18m^2) + (0.5 + j0.866)\log_h (1.5 \times 1.732m^2)] = j\,\frac{\omega 2I}{10^9}\,(\frac{1}{2} + \log_h \frac{m}{r} + 0.038 + j0.152)$ volts per centimeter

E_b = reactance drop in $B_1 = j\,\frac{\omega 2Ia}{10^9}\,(\frac{1}{2} + \log_h \frac{m}{r} - 0.137)$

E_c = reactance drop in $C_1 = j\,\frac{\omega 2Ia^2}{10^9}\,(\frac{1}{2} + \log_h \frac{m}{r} + 0.038 - j0.152)$.

I is the absolute, or measured, value of current in each conductor in amperes.

$\omega = 2\pi f = 2\pi \times$ cycles per second.

The values of a and a^2 are given in the appendix.

Without going in detail into the matter, it is useful to apply three equations given by C. L. Fortescue.*

First, the average reactance drop is:

$$E_{a_2} = \tfrac{1}{3}(E_a + a^2E_b + aE_c) = j\,\frac{\omega 2I}{10^9}\,(\tfrac{1}{2} + \log_h \frac{m}{r} - 0.020).$$

Also $$E_{a_1} = \tfrac{1}{3}(E_a + aE_b + a^2E_c) = j\,\frac{\omega 2I}{10^9}\,(0.073 + j0.127).$$

This is a measure of the unbalance and is known as the "reversed phase sequence voltage."

Finally $$E_{ao} = \tfrac{1}{3}(E_a + E_b + E_c) = j\,\frac{\omega 2I}{10^9}\,(-0.015 + j0.025)$$

This is an equal voltage drop in all three conductors of the circuit. It is small in the cases here considered.

If the same quantities are calculated for Fig. 2, then:

$$E_a = j\,\frac{\omega 2I}{10^9}\left(\tfrac{1}{2} + \log_h \frac{m}{r} + 0.673 + j0.519\right),$$

$$E_b = j\,\frac{\omega 2Ia}{10^9}\left(\tfrac{1}{2} + \log_h \frac{m}{r} - 0.137\right),$$

$$E_c = j\,\frac{\omega 2Ia^2}{10^9}\left(\tfrac{1}{2} + \log_h \frac{m}{r} + 0.673 - j0.519\right),$$

$$E_{a_2} = j\,\frac{\omega 2I}{10^9}\left(\tfrac{1}{2} + \log_h \frac{m}{r} + 0.403\right),$$

$$E_{a_1} = j\,\frac{\omega 2I}{10^9}\,(+0.285 + j0.493),$$

$$E_{ao} = j\,\frac{\omega 2I}{10^9}\,(-0.015 + j0.025).$$

The quantity $\left(\frac{1}{2} + \log_h \frac{m}{r}\right)$ may be taken as 5.5 for an average transmission circuit. Then the value of E_{a_2} is 5.480 for Fig. 1 and 5.903 for Fig. 2.

It is seen that the average voltage drop, E_{a_2}, is 7 per cent less for Fig. 1 than for Fig. 2. The reactance drop for Fig. 1 is less than if there were no load in the

*"Method of Symmetrical Co-ordinates Applied to the Solution of Polyphase Networks," by C. L. Fortescue, *Trans. A. I. E. E.*, 1918, equations (5) and (6), page 1034.

second circuit on the tower, and it is even less than for one isolated circuit with equilateral triangular spacing of side m.

The unbalance, represented by E_{a_1}, is less than one-third as great in Fig. 1 as it is in Fig. 2. While transposition of the conductors every few miles gives theoretically equal reactance drops in the conductors and removes the unbalance, the correction cannot be perfect, and it is better if the unbalance in each section of the line is small.

It is evident that the arrangement of Fig. 1 is preferable in every way to that of Fig. 2, and no expense is involved in adopting it.

If B_1 and B_2, in Figs. 1 and 2, are brought in line with the upper and lower conductors, so that each circuit has flat spacing, the method of connection of Fig. 1 gives 9 per cent less reactance drop than the method of Fig. 2, but the unbalance is slightly greater with the method of Fig. 1.

An interesting case, although not a practical one, is when the six conductors are spaced at the corners of a regular hexagon having all its sides and angles equal. Here the method of connection of Fig. 1 gives 11 per cent less reactance drop than the method of Fig. 2. The unbalance is zero with the method of connection of Fig. 1 and with equal loads on the two circuits, but there is considerable unbalance with the method of Fig. 2.

This general method of calculation can be used for determining the reactance drop and the effect of mutual inductance and of different methods of transposing conductors, etc., with various combinations of alternating-current circuits.

APPENDIX

$$\text{Let } a = \cos 120^\circ + j \sin 120^\circ$$
$$= -0.5 + j0.866 \quad (1)$$
$$a^2 = (-0.5 + j0.866)^2$$
$$= -0.5 - j0.866$$
$$= \cos 240 \text{ deg.} + j \sin 240 \text{ deg.} \quad (2)$$
$$\text{Then } 1 + a + a^2 = 0. \quad (3)$$

Find the reactance drop in conductor A_1, taking into account magnetic flux up to a certain large distance p. This quantity p vanishes later by applying equation (3).

Let the current in conductors A_1 and A_2 due to the load, which is the same in both circuits, be I. Then the current in B_1 and B_2 is Ia and the current in C_1 and C_2 is Ia^2.

The reactance drop in conductor A_1 due to its own current is $j \frac{\omega 2I}{10^9} \left(\frac{1}{2} + \log_h \frac{p}{r} \right)$ volts per centimeter.

The reactance drop in conductor A_1 due to current I in another conductor at a distance m is

$$j \frac{\omega 2I}{10^9} \left(\log_h \frac{p}{m} \right) \text{ volts per centimeter.}$$

The reactance drop in A_1 due to the currents in the six conductors is

$$j \frac{\omega 2I}{10^9} \left[\frac{1}{2} + \log_h \frac{p}{r} + a \log_h \frac{p}{A_1B_1} + a^2 \log_h \frac{p}{A_1C_1} + \log_h \frac{p}{A_1A_2} + a \log_h \frac{p}{A_1B_2} + a^2 \log_h \frac{p}{A_1C_2} \right]$$
$$= j \frac{\omega 2I}{10^9} \left[\frac{1}{2} - \log_h (A_1A_2 \times r) - a \log_h (A_1B_1 \times A_1B_2) - a^2 \log_h (A_1C_1 \times A_1C_2) \right], \quad (4)$$

using equation (3).

The reactance drop in B_1 is:

$$j \frac{\omega 2Ia}{10^9} \left[\frac{1}{2} - \log_h (B_1B_2 \times r) - a \log_h (B_1C_1 \times B_1C_2) - a^2 \log_h (B_1A_1 \times B_1A_2) \right]. \quad (5)$$

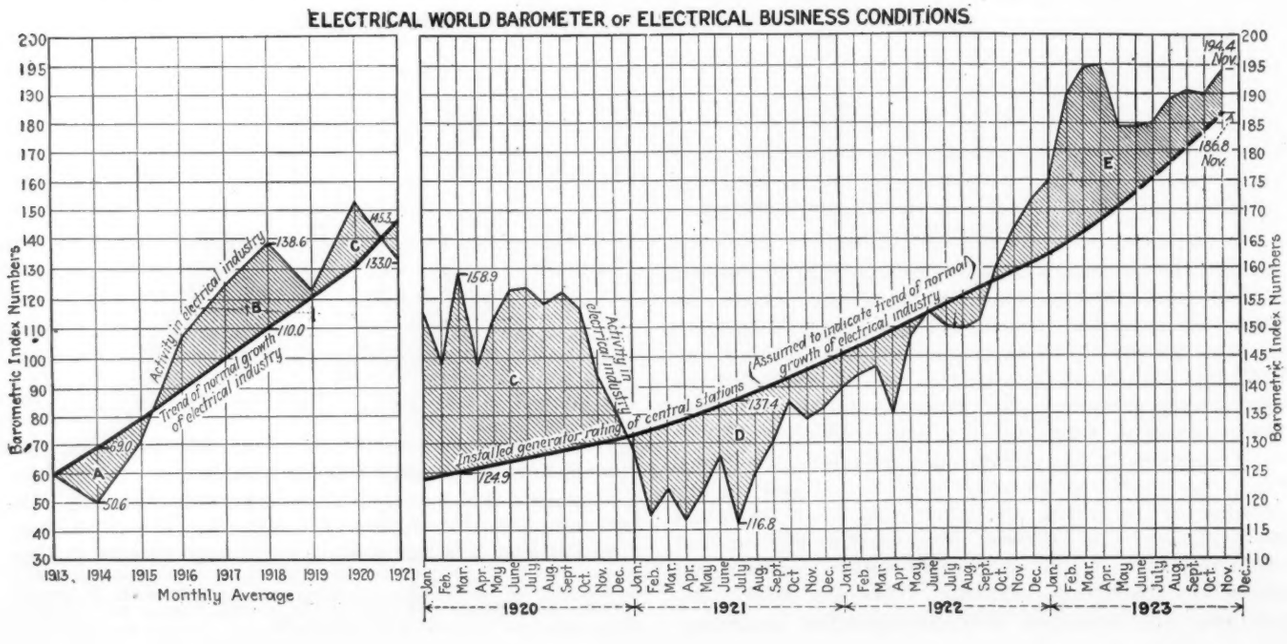
The reactance drop in C_1 is

$$j \frac{\omega 2Ia^2}{10^9} \left[\frac{1}{2} - \log_h (C_1C_2 \times r) - a \log_h (C_1A_1 \times C_1A_2) - a^2 \log_h (C_1B_1 \times C_1B_2) \right]. \quad (6)$$

November Activities 7.6 per Cent Above Normal

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate that while activities in many of the industries of the country were further curtailed as compared with October, some of the industries largely influencing activities in the electrical industry reported activities above those of October.

The data upon which the "ELECTRICAL WORLD Barometer" is based indicate an increase of one point on the scale as compared with October activities. During this interval the industry has grown 3.3 points, leaving a net increase in activities of 4.3 points on the barometer scale as compared with October. The electrical industry as a whole was operating in November at 7.6 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In October it was operating at 6.6 and in September at 9.9 points or per cent above the point of normal demand.


ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS
Barometric Index Numbers
Activity in electrical industry
Trend of normal growth of electrical industry
Monthly Average
Activity in electrical industry of central stations
Assumed to indicate trend of normal growth of electrical industry
Installed generator rating
1913 1914 1915 1916 1917 1918 1919 1920 1921
1920 1921 1922 1923

Who Sells Electrical Appliances?—III

A City of 800,000

"Electrical World" Survey of Retail Appliance Selling in a City Where Favorable Trade Relations Exist — Volume of Sales Almost Equally Divided Among Three Classes of Dealers

IN THE two cities previously described in the *Electrical World's* survey of appliance sales trade relations among different classes of dealers were not exactly harmonious. Price cutting and unethical competitive practices were very much in evidence. Almost the other extreme of conditions was found to prevail in the city here discussed. The dealers, whether they were electrical or non-electrical, appeared too busy taking care of their own business to find time for worry about competition from others. It should be remembered in this connection that observations regarding significant conditions or trends are based solely upon obvious circumstances obtaining in a city, or statements from the dealers themselves.

WIDE diversity of industries and business characterizes this city. Its population of approximately one million, including suburban towns, is representative of a growing American manufacturing city, and while it has a distinctly metropolitan atmosphere, nevertheless its citizens are inclined to be more or less conservative.

Conditions which affect appliance selling present a considerably different aspect from that found in the two other cities already described. Competition is on a very clean-cut basis, and so far as could be learned there was no dealer of any class who had a serious complaint to make against any of his competitors. The business is conducted by all dealers on a profit-making basis, the energy-consumption value of appliances being a secondary consideration for the central-station company. There is an electrical league, which from all reports is functioning satisfactorily, and relations between contractors, dealers and the central-station company are most harmonious.

HARDWARE DEALERS

There were only two hardware stores of importance which carried a representative line of electric appliances, and the combined sales of both approximate less than 1 per cent of the total for the city. One of these stores does a very small amount of business comparatively and might well be eliminated from consideration as the owner was not convinced that electrical appliances were suitable for his line. Discounts were too short and there was little natural demand so far as he could see.

Hardware dealer "A" was established in the heart of the shopping center and had an attractive, up-to-date store. The stock carried was of high grade and most of the business resulted from the sale of smaller appliances. Installment payments were not offered, therefore comparatively few of the higher price devices were sold. Discounts, this dealer thought, were a little too short to allow for advertising and other selling expenses. However, he was mildly enthusiastic about the business, as it was growing steadily, and in his opinion a hardware store is a natural outlet for electrical appliances. He had no criticism to offer of the central-station company or other dealers in so far as their selling policies were concerned. He did say, however, that some of them were rather poor merchants and did not appreciate the value of a good location for their stores, display of goods or advertising. He could give no idea of the relative amount of profits from his electric appliance sales as compared with other items of hardware stock, as no separate accounting was done. He was positive that it showed a profit and that a wider margin could be looked for as the business increased from year to year.

ELECTRICAL DEALERS

In order of their importance as outlets for electrical appliances dealers here may be grouped into three classes: (1) Factory branch or specialty stores, (2) electric shops, (3) contractor-dealers. Relations among these different stores appear to be quite amicable, and there is virtually no criticism either of the central-station company's policy or the department stores which are active in the sale of electric appliances. Factory branch stores are considered as those representing manufacturers of washing machines, vacuum cleaners and ironing machines. These three devices constitute their principal stock and in most cases smaller appliances are not carried at all. At least 95 per cent of the sales made by these stores are by outside salesmen calling upon prospective customers whom they develop or who are finally gained through advertising in the daily papers or direct-by-mail circularization. Some of these stores are operating resale contracts in conjunction with the central-station company or the department stores. Factory branch stores are, for the most part, located in the shopping districts, but not in the busiest section.

Electrical dealer "E"—a factory branch store—estimated that there are in use in the city between 50,000 and 60,000 electric washing machines. Nearly all of these have been sold by outside salesmen, and in his opinion the sales of larger appliances will continue to be made in this manner. The greatest difficulty experienced has been the great variety of machines on the market, which tends to confuse the purchaser. Within the last five years 134 different makes of electric washers have been offered in the city. Not all of these were on the market at one time, of course, but it shows the keen competition on this particular appliance. Many of those which were sold have since become "orphans," and it is impossible for the user to obtain repair parts.

This dealer emphasized the difficulty in finding reliable salesmen. This appears to be the keenest source of worry among all factory branch stores. It is also one of the principal reasons why the manufacturers have established these retail outlets. It enables them to train their salesmen and exercise better control over the retail selling. Although they say that it is not the most desirable form of distribution, it has been found to be the only practicable scheme.

Other factory branch managers were of virtually the same opinion. It was apparent, however, after talking to many of them that their principal reason for existence was because of their failure or inability to make a satisfactory connection with some already established retail outlet, such as a central-station company or department store. Many of these stores find that business comes hard, that there is but little natural demand on the part of the public such as is manifested by people coming into their stores and buying without previous solicitation. Such customers usually patronize department stores, or perhaps the central-station company. It appears inevitable that a number of factory branch stores must sooner or later drop out because of several adverse conditions which confront them. First, their manufacturer may go out of business or consolidate with some one else. Second, competition may be too keen. Third, there is difficulty in obtaining a sales force and the turnover is very high. Fourth, financing of sales is a problem because at least 80 per cent of the appliances which they handle are sold on deferred payments. Fifth, the factory branch store is really a manufacturer's expedient to increase sales and would not be resorted to if other satisfactory retail outlets could be found. Sixth, there is a natural tendency on the part of the public to buy such electrical appliances either from the central-station company or from the department, hardware or house-furnishing store.

The electrical contractor-dealers are strongly inclined to confine most of their efforts to electrical wiring and the sale of fixtures. Electrical appliances are carried and sold, but for the most part are very decidedly a side line and serve more to round out the contractor's business than to furnish a large part of the gross revenue. It is doubtful whether the sale of electrical appliances by contractors constitutes as much as 10 per cent of their total business. Relations between these dealers and the central-station company appear to be extremely cordial.

The third type of electrical dealer is the electric shop, doing a miscellaneous electric supply and appliance business. The two most important stores of this type, it should be noted, also do a jobbing business. One of these, dealer "H," is one of the old-established concerns in the city. It has built up a very high reputation with the public for fair dealing and reliability and, furthermore, is a firm believer in extensive newspaper advertising. This store spends 8 per cent of its gross retail revenue on advertising and declares that it pays. The sales plan is to map out and carry through a specific campaign based principally on advertising. The manager declared that this practice had proved very efficient, particularly in interesting people sufficiently to visit the salesroom.

Electrical dealer "K" was chiefly a jobber, but also conducted a retail store given over mostly to radio supplies. The sales manager's comments here with reference to the value of different retail outlets were interesting. He appeared to have a good estimate of the situation, stating that the appliance business was pretty evenly divided between the central-station company, the department stores and the remaining electrical dealers of all kinds. He said that for their purpose they would much prefer to have a department store or a hardware dealer to act as a representative in a given territory than an electrical contractor. The chief reason for this was that the department stores and hardware men are real merchants and can be depended upon to move their stocks. On the other hand, with the contractor-dealer the appliance business is frequently of minor

SALES OF PRINCIPAL ELECTRICAL APPLIANCES, SHOWING QUANTITY, VALUE AND PROPORTION SOLD BY HARDWARE STORES, DEPARTMENT STORES, ELECTRICAL DEALERS AND THE CENTRAL-STATION COMPANY

Kind of Dealer	Washing Machines	Vacuum Cleaners	Ironers	Flatirons	Curling Irons	Toasters	Percolators	Total Sales Each Class of Store	Per Cent of Total for City
Hardware Stores									
Store "A"	25	25	.....	500	350	200	250		
Store "B"	5	.....	.....	125	75	25	24		
Total	30	25	.....	625	425	225	274		
Value	$3,750	$1,312	.....	$3,750	$1,912	$1,350	$3,288	$15,262	0.8
Per cent of electric appliance sales	24.2	8.6	.....	24.2	12.4	8.7	21.9		
Department Stores									
Store "C"	750	875	50	1,000	900	450	350		
Store "D"	1,200	1,350	150	1,500	1,200	375	225		
Store "E"	425	600	.....	1,200	800	300	200		
Total	2,375	2,825	200	3,700	2,900	1,125	775		
Value	$296,775	$148,312	$30,000	$22,200	$13,050	$5,750	$9,300	$326,387	28.5
Per cent of electric appliance sales	56.3	28.2	5.7	4.3	2.5	1.3	1.7		
Electrical Dealers									
Dealer "F"	400	350	50	.....	.....	.....	.....		
Dealer "G"	350	200	25	250	425	125	80		
Dealer "H"†	350	325	20	.....	.....	.....	.....		
Dealer "I"	250	300	20	600	300	250	100		
Dealer "J"	125	100	.....	325	200	125	75		
Dealer "K"†	.....	.....	.....	400	325	150	90		
Dealer "L"*	50	40	6	600	150	130	36		
Dealer "M"	400	325	30	.....	.....	.....	.....		
Dealer "N"	350	200	.....	550	225	175	100		
Dealer "O"	.....	.....	.....	225	75	100	50		
Dealer "P"	.....	2,100	.....	.....	.....	.....	.....		
Dealer "X"* (6 misc.)	250	300	12	1,000	450	300	100		
Total	3,025	4,240	173	3,950	2,150	1,355	631		
Value	$378,125	$222,600	$25,950	$23,900	$9,675	$8,130	$7,572	$675,952	36.7
Per cent of electric appliance sales	55.9	32.9	3.8	3.6	1.5	1.2	1.1		
Central-Station Company									
One company	2,325	3,300	225	20,100	1,100	1,120	665		
Value	$290,625	$163,250	$33,750	$120,600	$4,950	$6,720	$7,980	$627,875	34.0
Per cent of company's electric appliance sales	46.2	26.0	5.4	19.3	0.8	1.1	1.2		
Grand Total									
All dealers	7,755	10,700	598	28,385	6,575	3,825	2,345		
Value	$969,275	$535,474	$89,700	$170,450	$29,587	$22,950	$28,240	$1,845,476	100.0
Per cent of total sales	52.3	29.0	4.8	9.3	1.7	1.3	1.6	100.0	

* Contractor-dealers. † Electric shops—also do jobbing business.

consideration and it is allowed to stagnate from lack of attention. He felt that the department store would continue to be an increasingly important factor as an outlet for electrical appliances, and of the larger devices they would sell as many as, if not more than, the central-station company. It was also his opinion that only the strongest and best organized factory branch stores and electric specialty shops could expect to survive.

Department Stores

There are three large department stores closely grouped in the shopping center of the city. All of these carry good stocks of electrical appliances and are active in pushing them, some to a greater extent than others. All carry electrical appliances as an adjunct to their house-furnishing departments and would give no definite figures as to the profits from the business except to state that they were satisfactory, otherwise they would discontinue the line.

Department store "C" is of a very high class and its display of electrical appliances was the most attractive seen in any of the department stores visited. Only standard high-grade appliances were carried, and the two large appliances—washing machines and vacuum cleaners—were sold on a resale agreement. While no separate department is intentionally maintained, electrical appliances are grouped together and have probably the best location in the house-furnishing department. Sales of electrical merchandise for 1923 will show an increase of aproximately 30 per cent over those of last year. No special advertising has been done, but they receive the same amount of attention in the store's newspaper advertising as other lines of merchandise. The department manager declared that he considered it absolutely necessary to offer deferred payments on the higher-priced appliances, and he believed that this is the accepted custom of the American public in purchasing much of its household equipment, particularly that which costs from $50 upward.

Asked if he used electrical appliances as leaders or made special prices on them, he replied that it was not the policy of the store to offer appliances at extreme reductions, but at times discounts of 10 to 15 per cent were offered, and if a particular device or line proved to be slow-moving, he felt it was legitimate business to reduce the price to a point which would move the merchandise. Discounts, he said, were fairly satisfactory, and he pointed out that nearly all purchases were made direct from the manufacturers. Competition and selling policies of the central-station company and other dealers were as fair as could be asked. He also stated that much of the business the store was getting was coming in voluntarily, and in his opinion the business would continue to grow at an average increase of from 15 to 20 per cent per year.

Department store "D" is an extensive advertiser and makes price the leading feature of its advertisements. The larger appliances are being demonstrated all the time, which has proved an effective means of attracting the attention of shoppers to the department. Nine makes of washers were on display on the floor—four of which were being sold on a resale plan; two were carried in stock and sold outright, and three makes were on a consignment basis. Two makes of ironing machines were being displayed, and these were also being sold upon a resale plan. The manager of this store declared that the electrical appliance business had increased almost 35 per cent over 1922 in the last year, but did not hope to see such a rate of increase continue from year to year. He did not feel that the central-station company was in any way trying to monopolize the field. He believed that the fact that department stores are becoming an important outlet for electrical appliances is due to the natural tendency of the public to buy more and more in these stores. He pointed out that the enormous buying power of the department store would make it possible, if necessary, to undersell almost any competitor. He also said he did not believe that the small electrical dealers, either individually or as a group, would long be an important factor as a retail outlet for electrical appliances.

In department store "E" the sale of electrical appliances had not been developed to the extent that it had in the other two stores. The manager of the house-furnishing department here said that while the business is profitable the increase from year to year has been only moderate, approximately 10 per cent, and that he was inclined to feel out the attitude of the shopping public a little more before he enlarged the store's activities in this direction.

Like the other merchants, he was favorable to the central-station company and thought there was enough business in the city for all of those at present engaged.

Central-Station Company

The central-station company has a most attractive salesroom in its office building, which is situated in a good location, although a little outside of the main shopping center. Appliances are well displayed, and salespeople are extremely attentive and courteous. No outside selling force is maintained directly by the company, although washing machines and vacuum cleaners are sold upon a resale plan. The company has been very successful in fostering good public relations and has the almost universal support of its customers. They are inclined to buy from the company whenever possible, and other dealers and merchants say, without malice, that the people like to buy from the company. All small appliances are stocked and sold direct by the company and liberal deferred payments are offered. The company sells at list prices except when it is conducting special sales, when discounts of 10 or 15 per cent are offered. This appears to be general practice in the city and is not frowned upon by any of the competing dealers.

The total sales of electrical merchandise through retail outlets amounted to upward of $2,250,000 in 1923. This, of course, includes only the appliances and does not take into consideration miscellaneous supplies, radio or incandescent lamps. (It should be noted that in the accompanying tabulation only seven appliances are listed for comparative purposes, therefore the apparent discrepancy in total sales.) The three principal outlets—i.e., central-station company, department stores and electrical dealers—are at this time of almost equal importance when considering the total volume of sales. On a percentage basis they may be compared as follows: Department stores, 28.5; electrical dealers, 36.7; central-station company, 34.0. Hardware stores account for the remaining 0.8 per cent.

With the very definite trend away from the small dealers toward the department store and the unusual popularity of the central-station company in this city, the next three years will probably see a rearrangement of these percentages, with a result about as follows: Department stores, 37.5; electrical dealers, 23; central-station company, 37.5; hardware stores, 2.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Highway Lighting Advocated as Safe and Proper Procedure

To the Editors of the ELECTRICAL WORLD:

It seems to me that E. J. del Vecchio in his letter published in the ELECTRICAL WORLD of Dec. 22, 1923, in which he opposes plans to light country highways by electricity, is overlooking some important factors in relation to highway lighting which are worthy of careful consideration.

The danger of automobile headlights powerful enough to "pick up" pedestrians or obstructions at sufficient distances to enable the driver to avoid accidents is generally admitted, and, in order to eliminate the necessity for these headlights, it is essential that pedestrians and obstructions should be made visible by other means, such as adequate street and highway lighting for all localities.

Highway lighting is but another step toward perfection. In primitive times before street illumination was general pedestrians used to carry lanterns just as vehicles are compelled to carry them now. It is evident that if adequate illumination were provided on our highways as on city streets, vehicle drivers would be able to dispense with their headlights just as pedestrians have dispensed with their lanterns on city streets.

Vehicle drivers are held responsible for any damage they may do to a pedestrian (who carries no light), and it would appear therefore that the lights carried by an automobile are not for the purpose of warning the pedestrian, but to illuminate and make known his presence, so that the driver may avoid an accident.

Scientifically designed street-lighting installations do not cast objectionable shadows as suggested by Mr. Vecchio, and a well-designed highway lighting system is also free from shadows.

L. A. S. WOOD,
Manager Street Lighting Section.
Westinghouse Electric & Manufacturing Company,
South Bend, Ind.

Municipally Owned Utilities

To the Editors of the ELECTRICAL WORLD:

In connection with the letter from A. T. Clark, published in the Dec. 15 issue of the ELECTRICAL WORLD, page 1222, and your editorial note, the following quotation from the second edition of the bureau's "Standards for Electric Service," page 8, may be of interest:

"In a number of the states the public service commission law does not give the commission jurisdiction over municipally owned plants, but in Colorado, Indiana, Maine, Maryland, Missouri, Montana, Nevada, New Jersey, New York, Rhode Island, Utah, Vermont, West Virginia, Wisconsin and Wyoming municipally owned utilities are under the jurisdiction of the commission."

The American City Government League of Brooklyn, N. Y., has prepared a very concise analysis of the laws affecting municipally owned utilities.

J. FRANKLIN MEYER,
Physicist.
Department of Commerce, Bureau of Standards,
Washington, D. C.

Calculating the Torque of a Single-Phase Motor from Theory May Introduce Errors

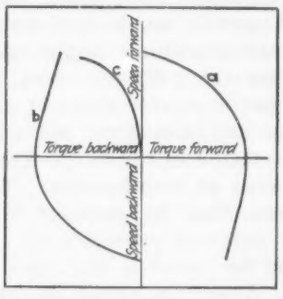
To the Editors of the ELECTRICAL WORLD:

The development of a useful idea is often greatly delayed when erroneous deductions are made from it or when arbitrary limits are ascribed to its field of usefulness. For example, in the early nineties Professor Ferraris suggested that single-phase induction motor operation be explained by considering a single-phase magnetic field as made up of two oppositely rotating fields.

The method of calculating the torque of a single-phase motor used by Prof. J. H. Morecroft and M. Arendt, in an article in the *General Electric Review*, illustrates a common and incorrect application of Ferraris' suggestion. This article is reprinted in "Electric Motors," by Francis B. Crocker and Morton Arendt. The formula given on page 225 of that book is:

$$T = T_1 + T_2 = \frac{N_2^2 e^2 r_2 (s_2 - s_1)\ (s_1 s_2 X_2^2 - r_2^2)}{\omega_1 (r_2^2 + s_1^2 X_2^2)\ (r_2^2 + s_2^2 X_2^2)}.$$

According to this formula, the torque of a single-phase motor is the differential torque of two polyphase motors connected for opposite phase rotations and with the same voltage impressed on their terminals. One of the conclusions to which this formula leads is "that the single-phase induction motor cannot operate unless the reactance of its rotor winding at standstill is greater than its resistance." Reference to the sketch will show the line of reasoning followed. Assume the secondary resistance equal to the total reactance, in which case the polyphase torque is a maximum at approximately 100 per cent slip; that is, at a standstill. Curves *a* and *b* are respectively the torque curves of the forwardly and backwardly rotating fields. The resultant torque curve is represented by curve *c*, which has negative abscissas in the range from standstill to synchronism, and hence the machine acts as a generator. This is quite contrary to the fact, as the single-phase motor under these conditions develops a considerable positive pull-out torque.



THEORETICAL TORQUE CURVES OF INDUCTION MOTOR

Similar conclusions would be arrived at by using the methods shown on pages 848 and 849 of "Alternating Currents and Alternating-Current Machinery," by Dugald C. Jackson and John Price Jackson.

Prof. Ralph R. Lawrence, in "Principles of Alternating-Current Machinery," says that Ferraris' explanation omits several important factors and cannot be used for analytical development. This is placing an undue limitation on the idea of resolving a single-phase field into two oppositely rotating fields, as an analytical development based on it leads to an extremely simple method of determining the performance of a single-phase motor from the polyphase performance. The fact is that the usefulness of the idea is not limited to single-phase induction motors, but can be extended to many other problems, and the writer believes that but for incorrect applications it would have been developed to a much greater extent.

K. L. HANSEN.
Milwaukee, Wis.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Suspending Armored Cables in Mines

By W. E. Boyle
Engineer, New York, N. Y.

THE installation of shaft cables in mines depends on the type of mine, depth of shaft and the requirements of the colliery owners. If the mine pit is not of too great a depth, one of the simplest methods to install a paper-insulated cable is to suspend it from a special suspender at the top; but this method is obviously only for armored cables. Moreover, since the armor has to carry the entire weight of the cable, it is under continuous strain, and the stress set up in the cable is great enough to lead in time to the breakdown of the insulation immediately under the point where the cable is suspended, owing to the concentration of the strain at this part. Such a method is not advisable and should be used only when the guides for the cage are wire ropes and there are no stays to allow the fixings for cleats. Even then it is better to go to the expense of erecting special supports. The only real advantage in this manner of cable suspension is that falling bodies will not damage it owing to its swinging when any object comes in violent contact with it.

This suspender is usually in the form of a cone which is bored to allow the armor and lead to slip through easily. Over the top of the cone the armor wires are forced back and brought down on the outside. The conical wedge, when the armor wires are in place with no overlapping, fits in a seating of the same taper as the cone and is provided with side pieces to permit its connection to the "D" links of the supporting chains. The cup-shaped top of the suspender is then filled with bitumen, as shown in Fig. 1, to prevent corrosion of the wires. In a type such as this three-quarters of the breaking stress of the armor can be allowed for; if the armor has been designed with sufficient breaking stress, a safety factor of five can be assured.

One of the methods of installation when using such a suspender is as follows: Mount the drum on the cage and as it steadily descends pay it out. Care must be exercised to provide a method of braking the drum, otherwise it is liable to revolve by its own weight, causing the cable to loop, with disastrous results.

Never mount a drum at the pit bottom and pull up, since too much weight is thus thrown on the cable. This method is rarely possible owing to the fact that most shafts have insufficient clearance to allow the drum to be lowered.

The most popular and safest way to attain good results is as follows: A spare wire rope which is controlled by a haulage engine is lowered to the mouth of the shaft, the wire being long enough to reach the bottom and care having been taken beforehand to see that it is of sufficient strength to withstand the weight of the cable. The drum is mounted near the pit shaft with a plank answering for a brake, this serving only to check the revolving of the drum so as to prevent the cable from hanging in loops between the intervals of lashings on the steel wire. The drum brake will naturally not withstand the weight of the descending cable since this is being taken by the haulage engine. A staging can be fixed at the top of the shaft and the cable end fed in a suitable manner onto the wire rope, to which it is lashed by spun yarn as shown in Fig. 2, each lashing taking 150 lb. of the weight of the cable.

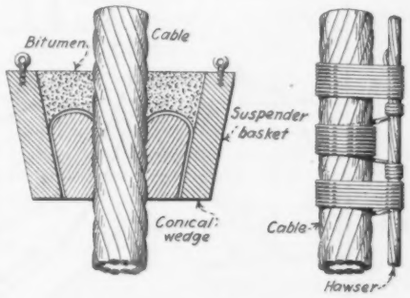


FIG. 1—THIS TYPE OF SUSPENDER GRIPS THE CABLE BY FRICTION INSTEAD OF BEING BOLTED DIRECTLY

FIG. 2—THE CABLE WEIGHT IS SUPPORTED BY THE LASHED HAWSER

This lashing is in three portions. The middle may be regarded as the foundation grip on the cable only, since it does not grip the hawser but consists of a double hitch with a half hitch above and below. The top portion of the lashing is next made and consists of three half hitches round the hawser only, followed by three more half hitches round both cable and hawser. The bottom portion is identical with the top. Finally, the two ends of the spun yarn are passed between hawser and cable, drawn tight and finished off with a double tie knot. If the staging has been correctly fixed, four lashings can be applied simultaneously for each engine stop. When the total length has been lowered an interval of ten hours or so is necessary before cleating up should take place. This is to allow temperature adjustment, as in very deep pits considerable difference is noted between the temperature of the mouth and that of the bottom. If the cable has been laid in hot weather, a sieve-like effect will be noted—which is advantageous as it provides against contraction at a low temperature.

Sometimes it is impossible to use the two above-described methods and other ways have to be found. Possibly the shaft may be of great depth, necessitating more than one length of cable to reach from surface to bottom; and since the necessary length of steel hawser may not be available, the lower lengths in that case would be coupled in tandem with the hawser. In such a case the rewinding of the cable directly on the drum of a haulage engine and controlling the lowering in this manner might be considered. Such a method with single-wire armor cable is never advisable and should not be attempted.

Another method is to connect the cable or hawser end to a locomotive which in turn is coupled to several loaded trucks acting as brakes. The entire length of cable is unreeled from the drum, one end of which

passes over a pulley and is then lowered down the shaft. However, both these methods should be looked upon as last expedients, and in these cases cleating up should be commenced as soon as the cable has been placed in position; that is, starting from the bottom, the cable being eased down from the surface after each cleat has been tightened.

Composition and Aging of Insulating Varnishes*

BY H. C. P. WEBER
Research Department, Westinghouse Electric & Manufacturing Company

PREVIOUS experiments have shown that during the natural oxidation of oil varnishes over a period of time the resistance of a varnished insulation may decrease. This decrease is the result of formation, by oxidation, of low-resistance materials, chiefly acids of lower molecular weight which are volatile and form conducting solutions with water.

A number of factors influence the amount of these low-resistance materials very markedly, and in making examination of varnishes for insulating purposes the test must be carried out under fixed conditions to obtain comparative values. The results given below were obtained by taking cotton strips and dipping unit lengths (1 meter) into the varnish and allowing them to drain. Under these conditions the average insulating varnish has become air-dry in forty-eight hours and sometimes in twenty-four hours, as is shown by the stoppage of weight loss due to evaporation and the physical condition of the tape. The various varnishes yield a varying quantity of varnish gum, depending on the nature of the varnish. In carrying out the examination for acidity a check is therefore obtained on the rate of drying and the body of the varnish. Enough strips were prepared so that a sample could be taken on successive days over a period of time. Certain of the samples were exposed to the air at normal temperatures, while a corresponding number of samples were "baked" at 100 deg. C. in order to obtain a comparison of the effects produced.

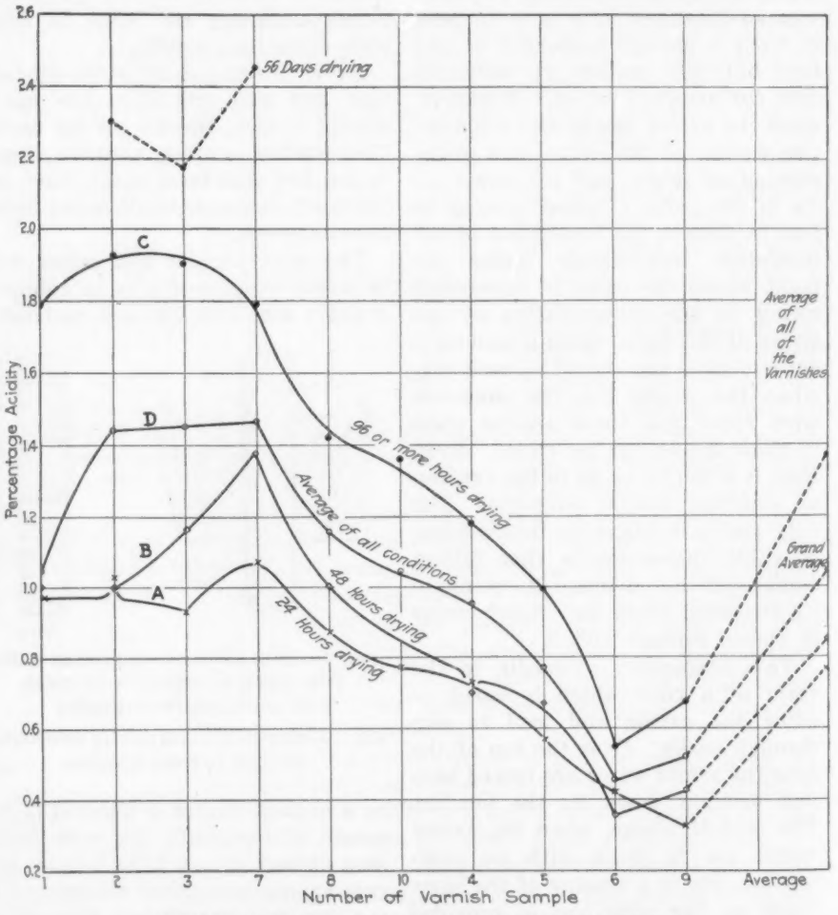
The formation of low-resistance materials in ten samples of varnish examined is shown in the accompanying illustration. The curves show that the amount of acidity formed is really a function of the time, increasing as the oxidation process progresses.

Another fact shown is that the values are really characteristic for the particular varnish. While the quantity increases with time, the order of the different samples remains essentially the same, so that, for purposes of comparison, a forty-eight-hour test period is as good as a ninety-six-hour period. The line marked "D" shows the average for all conditions and times, the value marked "grand average" indicating the averages of the ten samples again combined. This value shows that 1 per cent of water-soluble acid can normally be expected to exist in an air-dried varnish.

ACID CONTENT OF AIR-DRIED AND OVEN-DRIED VARNISHES

Material	Per Cent Oil	Average per Cent Acid—Air-Dried, per Cent	Average per Cent Acid—Oven-Dried, per Cent
Linseed oil:			
A.....	80	2.4	2.34
B.....	80	3.3	3.00
C.....	80	3.5	3.02
Restrainer:			
D.....	80	2.5	2.8
China wood	80	1.5	1.8
Linseed....	70	1.43	1.7
Linseed....	50	0.88	1.68

The results given in the accompanying table were obtained on specially prepared varnish samples. There were more than thirty samples of known composition, and a large number of tests were made so that the average results quoted here give a reasonably accurate picture of the true relations. The values given under "oven-dried" were obtained by baking for forty-five hours at 95 deg. Continued baking would, of course, finally remove the greater portion of the low-resistance material. The initial effect is to hasten its formation. Inspection of the results shows that, as far as the oils are concerned, linseed-oil varnishes are the most acid. China-wood-oil varnishes develop less acidity than the linseed-oil varnishes. With the same oil the acidity developed is greater the greater the percentage of oil in the varnish.



AVERAGE ACIDITIES OF TEN INSULATING VARNISHES

A is the average of four series of tests (thirty determinations), B of two series of tests (twenty determinations), C of five series of tests (fifty determinations), and D represents the average of all tests that were conducted.

*Abstracted from a paper presented before the meeting of the American Electrochemical Society at Dayton, Ohio, Sept. 27-29, 1923.

Determining Polarity of Current Transformers

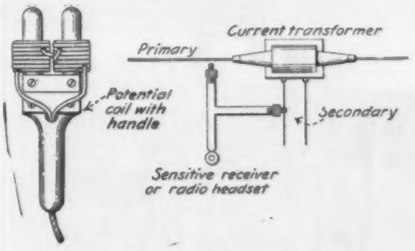
BY FOSS C. HUSH
Meter Engineer Iowa Service Company, Red Oak, Iowa

THE polarity of current transformers may be easily and positively determined while in active service by the method which makes use of the flux encircling a conductor carrying current. The apparatus consists of a sensitive receiver or radio head set and two potential elements (preferably for 220 volts) such as are used in the Duncan M-1 or M-2 watt-hour meter. For convenience in using, the elements may be easily mounted on wooden handles as shown herewith.

The two potential elements are connected in series with each other and the receiver. If one of the elements is placed near a wire carrying alternating current so that a pole of the potential element is on either side of the conductor, a hum will be heard from the receiver. If the other element is then placed in a similar position on the same wire, the hum will be louder or neutralized out completely, depending on its position. This is due, of course, to the fact that in one position the electromotive force of one element opposes that of the other, while in the other position their electromotive forces add to each other, thereby increasing the total current passing through the receiver. While the elements are in the position of neutralized hum a designating mark, such as an arrow head, should be placed on each element, pointing in the same direction along the conductor, after which the apparatus is ready for use.

To test polarity of a current transformer place one element on one of the secondary wires leaving the transformer, then approach the primary of the transformer with the other element, and a position will be found where the hum as noted when the first element was placed on the secondary side will be neutralized. The arrows previously placed on the elements will now indicate the relative instantaneous direction of primary and secondary current. The nearness to which it is necessary to bring the element to the primary will depend on the ratio of transformation and the value of current flowing. The higher the ratio the farther away will the point of neutralization be. Constructed from the parts mentioned, a distinct hum can be heard with 0.25 amp. flowing with the element astride the conductor. If 100 amp. were flowing in the primary, the element would not need to be closer than 3 in. or 4 in. to neutralize the hum picked up by the element on the secondary side.

This apparatus may also be used to check the secondary wiring from transformers to meter in cases where the wiring is run through conduit or for any reason cannot be visually traced. This is accomplished by placing one element at the current transformer and using the other at the meter, when again neutralizing the hum indicates that each element is on the same wire.



TELEPHONE RECEIVERS AND POTENTIAL COILS CAN BE USED TO DETERMINE POLARITY

Practical Coal Storage

IN DISCUSSING the fundamentals to be observed in storing coal with the minimum danger of spontaneous combustion, O. P. Hood, chief mechanical engineer of the United States Bureau of Mines, in a paper presented at the recent annual meeting of the A. S. M. E., said that there must be no heat added to the coal from outside, such as that from walls, feed pipes, oily waste, etc. If coal can be piled in pieces that will stay on a ¾-in. bar screen there will be no heating. The pile may be of any height, provided there be no fine coal. Where mixed lump and fine coal must be stored the pile should be so built as to avoid segregation of sizes. The production of fresh surfaces by breakage just before going into storage predisposes to spontaneous combustion unless the crushing is so fine and the packing of the pile so dense as largely to exclude air circulation. Coal should be so stored that its temperature conditions can be daily inspected. When any portion reaches a temperature of 140 deg. F. to 150 deg. F. there is a high probability that within a few days or weeks a destructive temperature will be reached. If the temperature reaches 160 deg. F. or 180 deg. F., there is almost a certainty that a destructive temperature will be reached. The best remedy is to move the warm coal so that it may cool.

The possibility of quick removal should be considered in storing coal. This factor, rather than any tendency to heating, determines the desirable size of the pile and its height. The tendency to heat differs in different coals, and experience is so far the best guide in determining this difference.

Overhead Distribution Construction

Standardized Practice as Developed and Used by the WEST PENN POWER COMPANY, PITTSBURGH

THROUGH the courtesy of the West Penn Power Company, Pittsburgh, the ELECTRICAL WORLD, beginning with this issue, will publish a series of articles based on the standard specifications for overhead distribution constructions as issued by this company.

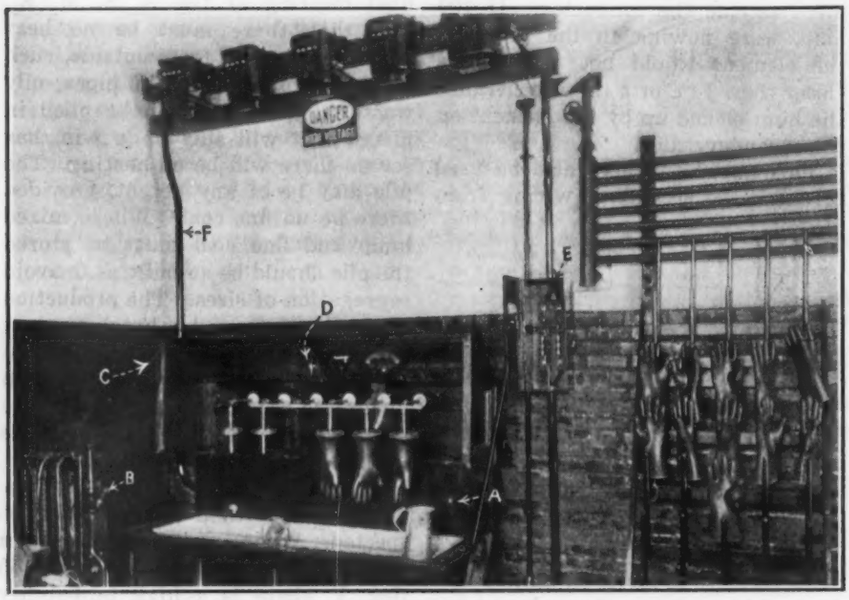
General Information

Climbers, connectors, pliers, safety belts and small tools will be supplied by the linemen, and all such tools and equipment shall pass a monthly inspection by the district safety inspector. Other tools, such as large wrenches, stocks and dies, digging tools, etc., as well as rubber gloves and protective equipment, and where necessary rubber boots and rubber coats, will be furnished by the company. Employees receiving tools or equipment from the company will be held responsible for their safekeeping and must return such tools or equipment upon completion of the work or upon leaving the employ of the company.

All foremen and assistant foremen shall receive from their superiors personal instructions as to the use of rubber gloves and protective devices and an explanation of all orders or letters pertaining to work performed by them. All employees shall be familiar with the safety rules of the company, so as to be able to answer any question on subjects covered, and foremen and assistant foremen shall see that this provision is carried out.

No work shall be done requiring the handling or touching of lines carrying voltages between 750 and 5,000 while they are "hot" except with the specific approval of the district superintendent or other authorized person in whose opinion such work is safe, and then only when it is not possible or practicable to take the lines out of service.

No work of any nature under any circumstances shall be done requiring the handling or touching of lines carrying voltages in excess of 5,000 volts while they are "hot."



CIRCUITS OF GLOVE-TESTING APPARATUS AUTOMATICALLY CONTROLLED

Glove-Testing Equipment

BY E. E. NELSON
Superintendent Blackstone Valley Gas & Electric Company, Pawtucket, R. I.

A GLOVE-TESTING installation embodying a number of interesting safety features has lately been made at the distribution building of the Blackstone Valley Gas & Electric Company according to the designs of S. T. Hilliard, substation foreman, who also assembled the equipment. The apparatus consists of a galvanized-iron tank inclosed in a wooden box having a weighted hinged cover with a glass panel permitting observation of gloves under test. The testing current is supplied through five small distribution transformers connected in series on the primary side and hung on the wall about 12 ft. above the floor as shown herewith.

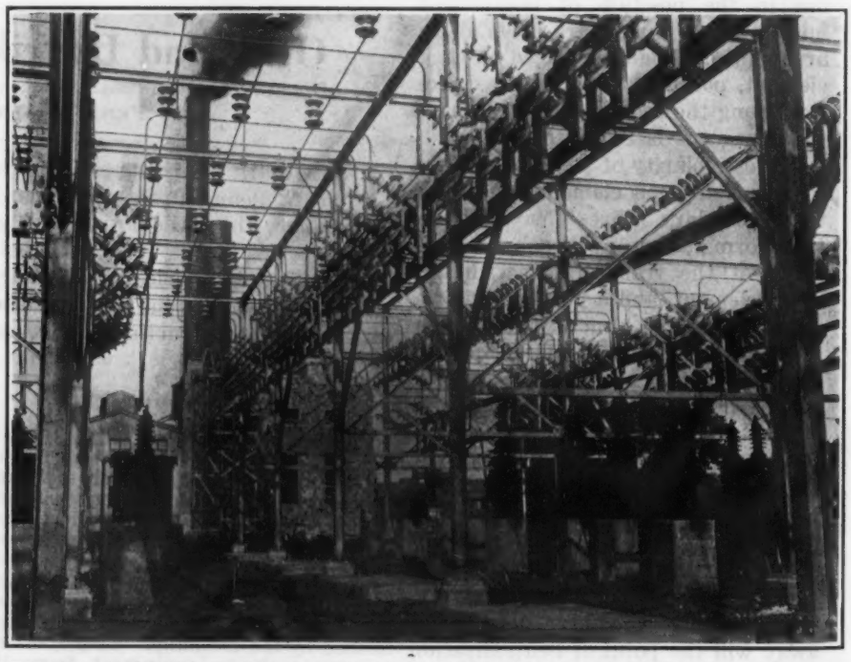
Energy is supplied to the transformers through a main switch *E* at 110 volts. This switch is controlled by a handle *A* and will stay closed only when the cover of the testing box is closed. If the box is opened, the switch flies open also. Current to the transformers is also broken by the 110-volt switch *C* on the test-box cover. The impressed voltage at the gloves is controlled by a rheostat handle *B*, which normally is held in an "off" position by a spring; so that in order to test gloves it is necessary to press down the handle *B*, and then any potential can be applied to the gloves from zero to 11,000 volts. Releasing the handle causes it to fly to the "off" position and disconnects the testing power.

The galvanized-iron tank inside the test box is the only high-voltage part of the apparatus. This tank is mounted on high-tension insulators. High-tension energy is carried to the tank from the transformers by an insulated wire inside the conduit *F* the conduit being grounded. The other side of the high-tension circuit is carried to the glove holders. This side of the circuit is grounded, so that there is no opportunity for getting a shock from it.

For protection in case of a short circuit due to a defective glove a circuit breaker *D* is provided. Should this fail, there are also fuses in the main switch box *E*. On the wall near the circuit breaker *D* is a voltmeter which indicates the potential impressed upon the gloves. This is connected on the 110-volt side of the transformers and is calibrated to read in high-tension volts. A rack for drying gloves is shown at the right. Lately there has been mounted inside the box a milliampere meter to measure the leakage current for all six gloves or any one glove.

In testing, the gloves are first placed on the holders hung in position and filled out of the galvanized-iron tank. Taking the water from the tank leaves the water remaining at the right height for testing purposes. After the gloves are tested the water is poured back into the tank. One quart of water suffices to fill the glove used by the company. It is customary to test all rubber gloves every two weeks when in use and also to test all new gloves. No glove is permitted to be used unless it has been tested within a period of three months. Gloves must stand a test of 10,000 volts for one minute, and the leakage current of any one glove must not exceed 10 milliamperes. For keeping records of tested gloves the company cements to each glove a piece of tire patch which has a number burned into it.

I-Beam Construction for Outdoor Substations



THE 33,000-volt outdoor substation construction shown in the above picture represents one of the best and most economical methods of laying out switching equipment for this voltage. No fabrication is used with this I-beam and column construction, and yet proper clearance space is available between switches, phase wires, buses and structural steel work.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Collections and Public Relations*

Delinquent Accounts Offer Many Opportunities to Make Firm Friends for the Company—Personnel of Collection Department Should Possess Tact and Ordinary Horse Sense

BY STEPHEN A. BIALECKI
Milwaukee Gas Light Company

ONE of the missions of the public utility company employee should be making friends for the company he represents. This he can do through courteous treatment and by taking a friendly interest in the patrons of his company. It is only a short while ago that the public utility credit man was looked upon as some one who did not exist, or at least there was a feeling that there was no reason for his existence—the general idea being that the utility companies had no credit problems, that their accounts were all secured and that if the monthly bill was not paid the service was discontinued immediately.

The first problem that we have to deal with is the case of the applicant for service, who does not invariably realize that he is asking for credit when he requests our service. He does not appreciate this fact until he is told that we carry his account approximately two months before the collection of a bill can be enforced. He does not approach our application desk as he would the desk of a credit man in the retail store, and it is therefore a delicate situation. Right at this point let me say that the person taking the application must use tact in broaching the subject of security or a credit reference. Your policy here will determine what sort of relationship you are establishing with your customer.

DANGER OF INDISCRIMINATE SHUT-OFFS FOR NON-PAYMENT

There seems to be a general impression that accounts with the utility companies will not be carried beyond a one month's bill and that failure of payment immediately results in a discontinuance of service. This is not the case. One of the functions of the credit department of the public utility is to pass on the overdue or delinquent accounts and extend credit according to the circumstances and condition of the delinquent customer. We must realize that we are dealing in a product that is not a luxury but an absolute necessity, the service of which cannot be dispensed with without discomfort and often danger, as in cases of sickness, so that the actual number of customers shut off for non-payment should be negligible. More than this, we should co-operate with the various charitable institutions and aid societies that frequently make request of us to carry, for varying periods, accounts in indigent cases. We often bring to the attention of these societies cases reported to us by our collectors.

MOST ACCOUNTS UNSECURED

The impression carried by the public that all our accounts are guaranteed either by signature of a responsible person or by cash deposit is of course erroneous. The fact is that companies are opening accounts on the merits of the representations made by the customer and 75 per cent of our business is carried on credit, unsecured. I think this will measure up pretty well with other lines of business selling on credit.

We are often charged with assuming an independent attitude because we do not face competition in our particular line. The fact, however, is that we can refuse no one service and are obliged to supply our service to any one applying for it. We cannot choose our customers as in the case of the retail merchant. Should the merchant choose not to open a charge account for an applicant, he can do so and there is no regulatory body to govern his action.

A great many of our public utilities, aside from selling their regular service, also handle and sell merchandise, such as appliances of all descriptions, the sales of which during the course of a year run into very large figures. The credit man here again must use a great deal of tact in passing on requests for credit because the average user of our service, when applying for credit on merchandise, comes to us with a feeling that he has already established sufficient credit relations when he opened his account for service. Care must be used here, for the customer who pays a monthly service bill promptly cannot be always accepted as a good credit risk.

HANDLING NEW CUSTOMERS

Because of the position of a company in the community where it operates without competition, there is a little undercurrent of prejudice, and in order to overcome this the credit department and application desk must work with a very definite idea of public service, and, as this is the first point of contact with the customer, the right kind of relations should be established between the customer and the public utility at the first meeting—that is, when the customer applies for service.

I think it is well for the credit department to have supervision over the collection department, because experience will tell us that the best relations that may have been established by any department can be overshadowed by some indiscreet action on the part of the collection department. The idea here is that complaints against the collection department can be handled through the credit department and act as a buffer between the collector and the consumer.

To revert to the problem of credit granting by a public utility, the question of policy is also involved. The fact here is that no general rule can be laid down to cover all companies as conditions vary with the community and location, so that what can be carried out in the way of policy in Milwaukee, where we have a very stable population, would not

*Abstract of a paper presented before the Accounting Section of the Wisconsin Utilities Association, Madison, Wis., Oct. 23, 1923.

work out well in a community with a floating population.

The one thing that must be generally borne in mind by the public utility credit employee, because of his peculiar relation with the public, is that he is not only dealing with the selling of a product of granting credit, but that the principal thing he must get across is our readiness to serve. When this is carried out efficiently, the principal asset of the company—good will—without which a public utility cannot make much progress, will show results that come back in dividends to all concerned.

SELECTION OF PERSONNEL

Now just a word concerning the collection department and the class of men that should be used on outside collections. While the work of a collector or agent, as I would prefer to call him, does not call for the highest intellect, we should, however, be very cautious in selecting our men. What we should look for is ordinary horse sense, a knowledge of human nature and a sympathetic understanding. While we do expect our collectors to make a reasonable effort at collection, it is more desirable to get a report of the actual conditions of the customer. Our experience has taught us that a lenient policy and a constant friendly touch with the customer, even though he may be delinquent habitually, will pave the way to good will as well as the ultimate payment of bills.

We remind our collectors from time to time that harshness and argument must not be resorted to in the course of their work. This policy prevails at all times, during business depression and non-employment periods as well, and while we carry a great many delinquent accounts for a considerable time, our percentage of losses will easily prove the consistency and reasonableness of a lenient policy, covered, however, by a positive follow-up system on all accounts. The result of such a policy as here outlined is further reflected by at least our own figures, which show that only five cut-offs for nonpayment of bills for each 2,300 customers are executed during the entire year.

A Challenge to Meter Readers

MORE than 45,000 meters per month are read by the flying squadron of Worcester (Mass.) Electric Light Company metermen photographed herewith, or an average of slightly more than 5,625 per man. J. Shea, second man from the left in the back row, holds a record of reading 70,000 meters in twelve months with but one detected error. The work is all done on foot, and while some apartment-house installations in Worcester carry banks of twenty to forty meters, the city has a large percentage of individual detached homes. George M. Hardy, general superintendent, and A. B. Sprague, head of the meter department, are looking for title disputants.

METER READERS OF THE WORCESTER ELECTRIC LIGHT COMPANY

Electric Water Heater 81.25 per Cent Efficient

AT A RECENT meeting of the Power Bureau of the New England division, N. E. L. A., the following test of a 3,000-watt automatic domestic water heater operating with a 20-gal. jacketed copper tank was presented by J. H. Jackson, power engineer, Keene (N. H.) Gas & Electric Company. The net cost of energy at the rate in effect was 3.6 cents per kilowatt-hour, and there were six persons in the family:

Duration of test in days	28
Total water used (hot and cold), gal.	7,495
Hot water used, gal.	1,405
Total water used per person per day, gal.	44.5
Hot water used per person per day, gal.	8.4
Total kw.-hr. used	455
Total kw.-hr., net cost	$16.39
Temperature of cold water entering heater, deg. F., approximate	40
Temperature of hot water leaving heater, deg. F., approximate	150
B.t.u. required theoretically to heat 1 gal. water from 40 deg. to 150 deg.	916
Kw.-hr. required theoretically (1 kw.-hr. equals 3,412 B.t.u.) to heat 1,405 gal. water from 40 deg. to 150 deg.	378
Efficiency of apparatus (378 ÷ 455), per cent	81.25
Actual cost to heat 1 gal. of water from 40 deg. to 150 deg., cents	1.16

A recording ammeter was in circuit throughout the test, and this showed that the third element of the heater came into operation only on Monday mornings for family laundry work, and then only for periods of ten to fifteen minutes.

Utility Investment House Forms Junior Department

THE Utility Securities Company, formerly the investment department of the Insull properties in Chicago, has formed a junior department, the purpose of which is to train the rising generation in the habit of saving and to educate them in the principles of sound investment as they approach maturity. The department is the outgrowth of the company's policy of thoroughgoing service to its clientele as it already has a women's department and a statistical department.

Outlining the policy of the junior department, Mrs. K. R. Eckstrom, the head of this new activity, says:

"The chief point our department is

trying to stress is that as the boys and girls develop in mind and imagination they will be more and more fascinated by the consciousness of ownership in the great industry that has been likened to the heart of modern American life. They will then be able to appreciate the work of the utilities that are pumping lifeblood in the form of electrical energy into the transmission lines supplying power to operate factories, street cars and the many appliances that lighten labor in the modern home.

"Children will receive stock certificates promptly upon completion of payments and thereafter will reap the rewards of self-denial in the shape of quarterly dividend checks."

Community Christmas Trees a Good-Will Opportunity

FROM an investigation just concluded by the Society for Electrical Development of the extent to which central-station companies are participating in the community christmas tree movement it is evident that this method of spreading Christmas cheer has reached larger proportions in a national way than had been believed possible. Returns received from about 105 cities and towns, representing all parts of the United States, indicate that central stations look upon this event as an opportunity to join in a civic activity which carries distinct possibilities for creating good will. The companies have not only contributed energy to light the trees, but have frequently done much of the work of procuring and erecting them.

Utilities serving a number of communities report having trees in a large proportion of the places served. A company in Massachusetts says that in each of the twelve cities served there was an 18-ft. or 20-ft. tree lighted by 200 lamps. Another company had 35-ft. trees in four of the large centers served by its lines. The company cuts, delivers and erects the tree and runs the service, in addition to donating the energy.

One of the large central-station companies which operates in the Middle West supplies energy free to trees in fourteen localities on its system. These trees are about 20 ft. in height and each requires twenty-five lamps. Trees from 30 ft. to 35 ft. high appear to be most generally used. Tacoma, Wash., Rome, N. Y., Savannah, Ga., and Washington, D. C., report trees varying in height from 40 ft. to 50 ft. The Madison Square tree at New York City was 80 ft. high. Twenty-five-watt lamps are most frequently used, although in some places 10-watt and 25-watt lamps have been employed effectively.

The accompanying table summarizes the data received from cities and towns representative of different parts of the country.

SOME CITIES WHERE THE COMMUNITY CHRISTMAS TREE HAS TAKEN ROOT

Name of City	Number of Trees	Number of Lamps per Tree	Height of Tree
New York	12	Various	Various
Detroit	1	300	35
Boston	1	600	40
Buffalo	4	200	...
San Francisco	2	500	...
Milwaukee	2	100	...
Washington	1	2,000	45
Seattle	6	300	30
St. Paul	2	300	30
	1	200	20
Atlanta	1	...	...
Reading	1	500	...
Tacoma	2	300	50
Utica	1	400	...
Denver	1	...	40
Savannah	1	510	44
Lansing	1	300	30
Tampa	3	50	...
Augusta	1	300	25
Madison	4	250	15
South Bend and 13 adjacent communities	20	25	20
Rome, N. Y.	1	250	50
Indianapolis and suburbs	6	50	30
	1	50	15
	32	20	8
Roswell	1	350	25
Prescott	1	75	30
Lexington	1	300	30
Reno	1	150	30
Waterbury	1	250	30
Poughkeepsie	1	300	35
Hagerstown	1	450	...
Rutland	1	300	30
Beaumont	1	300	30
Port Arthur	1	300	30

Sell 407 Washing Machines in One Month

BY W. T. RYAN
Washington Water Power Company, Spokane, Wash.

DURING the month of November the Washington Water Power Company sold 407 washing machines in Spokane and other towns served by the company. The gross sales value was $55,000, more than double the amount sold in a similar campaign a year ago.

In planning the sale a quota was assigned to each salesman, each sale representing so many points, depending upon the price of the machine sold. Prizes were given to the salesmen scoring the highest number. From the success of the sale the company feels that the quota system, based on points, causes the salesmen to exert a special effort to sell the better class of washing machines.

Approximately 1,000 in. of newspaper advertising featuring the washers was divided among three local newspapers. A broadside was sent to each customer calling attention to the low-priced Hurley oscillator, but mentioning also the Thor No. 25 and No. 26. Coming well in advance of the holiday season, and in view of the results, this sale indicates the value of careful planning and aggressive sales effort.

What Other Companies Are Doing

Brooklyn, N. Y.—More than $250,000 was recently distributed among employees of the Brooklyn Edison Company in the form of a gift of 8 per cent of each employee's annual salary. The money was distributed under a profit-sharing plan to employees who have been with the company two years or longer. More than 2,300 employees benefited by the plan.

New Haven, Conn.—The United Illuminating Company has announced a rate reduction from 7½ cents to 7 cents per kilowatt-hour, Albert W. Kraft, secretary, stating that the company desires to get back to a pre-war relationship with its customers notwithstanding the increased cost of labor and materials. It is estimated that the smallest customer will benefit to the extent of at least 50 cents per month by the reduction.

Augusta, Me.—A kitchen lighting unit campaign has been started by the Central Maine Power Company with a "bogey" of 5,000 100-watt six-dollar units in three months. About 375 units were sold during the first week. The fixture includes a self-contained switch. The company's total appliance sales in 1923 will approximate a half million dollars. George O. Smith is general sales manager.

Boston, Mass. — Utilities under the management of Charles H. Tenney & Company have reached the goal set in total appliance sales at the beginning of 1923, when a slogan "A Million or More Before Twenty-Four" was adopted throughout the sales organization. Cyrus Barnes, general sales manager, states that electrical appliances will probably account for more than $750,000 of this total. The quota set exceeded 1922 by 36.6 per cent. Christmas week trade in electrical appliances on these properties ran 60 per cent above last year's sales for the same period.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Photostat copies or English translations of complete articles will be furnished at cost upon request

Hydro-Electric Development and Steam Equipment

Generating Station with Hydraulic Accumulation.—E. RABNER.—The article gives an interesting account of a relatively small hydro-electric power plant which increases its capacity during six hours by pumping in the night time a large amount of water to an artificial storage basin which is about 1,200 ft. above the power house. A total of 17,500 kw.-hr. may be stored up, which is a considerable amount of emergency energy if compared with the total generator output of the 1,450-kw. plant. A special generating and pumping set is provided in the power house, consisting of a Pelton turbine of 2,100 hp. connected to a synchronous generator of 1,800 kva. and to a centrifugal pump with a capacity of 250 liters per second. A clutch is placed between pump and generator to disconnect the former while it is generating power. To operate more economically during periods of plenty of water, three small centrifugal pumping sets have also been installed in the station. Meters and registering instruments keep a constant record of the relation between the delivered and the expended power of the station. The over-all efficiency of the hydraulic accumulation is 52 per cent measured on the buses of the switchboard.—*Siemens Zeitschrift,* November, 1923.

Mercury-Boiler Installation.—A brief account of the development and problems encountered and a description of the Hartford Electric Light Company's mercury turbine and boiler installation, recently placed in operation.—*Power,* Dec. 4, 1923.

Coal-Haulage Problems.—Haulage as well as extraction needs to be considered in planning the layout of producing sections of mines. In the Lynch Mine No. 30 it was found advisable to bring the coal from the mine space by ponies to room headings and from this point to use trolley locomotives. Detailed descriptions of the haulage problems in this mine are given.—*Coal Age,* Dec. 13, 1923.

Generation, Control, Switching and Protection

The Single-Phase Auto-Transformer.—P. ANDRONESCU.—In a highly theoretical paper the author develops a circle diagram for the auto-transformer, showing the transformer's characteristics under all load conditions.—*Bulletin de Association Suisse des Electriciens,* October, 1923.

Five-Legged Transformer Cores.—ERICH KLEIN.—One of the most trying problems of very large transformers is their safe shipment. High capacity combined with high voltage gives a transformer such dimensions as to make transportation by rail difficult. A 110,000-volt, three-phase, 40,000-kva. transformer of normal design is nearly the largest machine capable of assembled shipment in a drop-frame car. A very material saving in over-all height on large three-phase transformers may be realized by designing the core with five legs instead of the customary three. This permits a reduction of the height of the yokes in the neighborhood of 50 per cent. It becomes thus possible to ship an assembled 80,000-kva. transformer. How to dimension the yokes and outer legs so as to carry the same flux is fully explained in the case of a typical 110,000-volt, 50-cycle, three-phase, 80,000-kva. transformer.—*Elektrotechnische Zeitschrift,* Nov. 15, 1923.

Performance of Auto-Transformers with Tertiaries Under Short-Circuit Conditions.—J. MINI, JR., L. J. MOORE and R. WILKINS.—A one-page abstract of this paper, presented at the Pacific Coast convention of the A. I. E. E., may be found in the Oct. 27, 1923, issue of the ELECTRICAL WORLD, page 864.—*Journal of A. I. E. E.,* December, 1923.

Units, Measurements and Instruments

Quantity Meter for X-Rays.—A. DAUVILLIER.—Based on the ionic principle, the author describes a very simple direct reading "dosimeter" for X-ray therapy or technical use of Roentgen rays. A small glass ball with a central electrode and conducting inner-sphere surface is placed in the path of X-rays and gives on a direct indicating galvanometer the amount of ray energy per second in ergs. The instrument needs to be calibrated but once, is absolutely mechanical in its use, being comparable to a pyrometer, and indicates the wanted value immediately. The apparatus, which has been primarily developed for medical use, should also be of value to the radio metallographer to determine quickly and exactly the purity of metals or alloys.—*Revue Générale de l'Electricité,* Dec. 8, 1923.

Impulse High-Voltage Test of Porcelain Insulators.—W. BUCKSATH.—In an impulse high-voltage test a voltage is applied which rises and decreases considerably faster than that of a 60-cycle sine wave. The voltage curve should resemble closely a rectangle. In the theoretical part of this paper the author considers a line where a capacity is connected at one end. He calculates the wave shape of the voltage at this end at the instant that the other end of the line is switched to a charged condenser. The results obtained are applied to impulse high-voltage testing of insulators. The author shows with statistics and failure curves that with impulse testing more definite specifications can be made than with low-frequency tests. The failure curve passes a saturation point—i. e., some insulators will not break down even after application of an extremely high number of impulses. The author recommends that tests be made only above the saturation point. He proves that defective insulators may pass the low-frequency test but will break down under impulse testing. *Elektrotechnische Zeitschrift,* Oct. 18 and Nov. 1, 1923.

Transmission, Substations and Distribution

The Arcing Ground.—H. G. NOLEN.—A discussion of the Petersen and Steinmetz theories with a special investigation about the magnitude of the voltage surges caused by arcing grounds. The Petersen theory is criticised because it does not consider the phenomena in the arc. The author holds that these phenomena determine the nature of the disturbances. He submits the phenomena in the arc to a special discussion.—*De Electrotechniek (Holland),* October, November and December, 1923.

Economic Consideration of Long High-Voltage Lines.—A. V. JOSLIN.—By taking a few typical examples of transmission lines the effect of power factor upon efficiency of transmission is shown. The most economical line power factor for any ordinary commercial transmission line is shown to vary by a comparatively small percentage and to be slightly less than unity.—*Journal of A. I. E. E.,* December, 1923.

Illumination

Artificial Illumination in the Iron and Steel Industry.—W. H. RADEMACHER.—During the last decade the application of artificial light in the iron and steel industry has undergone marked changes, with a distinct trend toward betterment. The modern incandescent lamp has rapidly displaced other forms of illuminants and in conjunction with modern reflecting equipment is today recognized as standard. Although much of the work involved in this industry is of a rough nature and does not necessitate lighting intensities of a relatively high magnitude, the requirements are nevertheless far from unimportant. Chief among the credits to the account of modern lighting are safety insurance and the twenty-four-hour day, attended by the successful coping with keen competition and the affection of economies in production. The selection and application of equipment for the various areas embraced in plant structure are exceptionally important problems, dictating as they do the success or failure of the resultant illuminating effect. In

this paper the requirements of the various sections and operations are treated in detail, recommendations being offered as to the best practice. Photographs illustrating the application of the modern principles discussed accompany the text.—*Transactions of the I. E. S.*, November, 1923.

Lighting Systems for Industrial Plants. — J. J. MCLAUGHLIN. — The author describes a small industrial plant in which by replacing drop-cord lighting with bare lamps by gas-filled lamps in efficient reflectors very satisfactory illumination resulted.—*Industrial Engineer*, December, 1923.

Motors and Control

Diagrams and Information on Two-Speed and Four-Speed Windings.—A. C. ROE.—The author, in the fourth of a series of articles on connecting induction motors, discusses multi-speed winding with connections for salient and consequent poles.—*Industrial Engineer*, December, 1923.

Harmonics in Single-Phase Series Motors. — R. LILJEBLAD. — The comparison between direct-current and single-phase current for railway electrification has been vital in Sweden during the last years in view of the proposed electrification of the railroad from Stockholm to Gothenburg. The main argument against the single-phase system for this electrication has been the question of telephone interference. In order to clarify this question the Allmänna Svenska Elektriska Aktiebolaget, Västeras, Sweden, undertook an investigation of the factors that influence the harmonics of the current in a single-phase series motor. The present paper is a report of this investigation. Apart from the electrostatic influence, which disappears at a reasonable distance from the transmission line, the telephone disturbance is due to harmonics in the single-phase current. These harmonics are of two kinds—"magnetic harmonics," resulting from the variations in reluctance due to the slots in the magnetic circuit, and "commutation harmonics," resulting from the induction during the commutation period. The former are relatively easy to eliminate, especially in motors with an odd number of slots per pair of poles, in which case it is sufficient to skew the slots one-half slot pitch. The investigation is, therefore, centered around the commutation harmonics. It is possible to dampen these harmonics by a condenser, coupled in parallel with the field winding, combined with a small transformer having a low reactance and a transformation ratio of about ten. The author gives a method for estimating the amplitudes of the harmonics that occur in the rotor winding as a result of straight-line commutation. The results are given in graphical form and the numerical values agree tolerably well with oscillograph readings. As a consequence of the investigation, the author maintains that a properly designed single-phase series motor should not produce more disturbance of this sort than a corresponding direct-current motor. This paper was read at the Electrotechnical Congress in Gothenburg, Sweden, 1923. — *Teknisk Tidskrift* (*Sweden*), *Elektroteknik*, Oct. 6, 1923.

Heat Applications and Material Handling

Electric Heating During the Past Ten Years.—E. ZEULMANN.—The author gives a general review of the latest developments and the various uses of electric heating, including some new details. Electro-steam boilers of the electrode type are being made today for as high as 20,000 volts and 6,000 kw. input. On electric railways such boilers, rated up to 1,200 kw., serve to heat the coaches during the winter season. New types of storage heaters are described which are charged at night and give off their heat during the day. Several new constructions of air heaters for small and large hot-air output and low and high air temperature are also described. Safety devices which will prevent overheating of household appliances, like flatirons, are shown in sketches. Finally, examples of electric heating of industrial machinery are given, and the many advantages which this method entails as compared with gas, steam and other sources of heat are explained. A great demand for electrically heated garments for aviators and car drivers, and for heated carpets and other products of the textile industry is being satisfied.—*Elektrotechnik und Maschinenbau*, Dec. 2, 1923.

Belt Conveyor for Coal Mines—A. F. BROSKY.—It is claimed that belt conveyors are well suited for hoisting coal which is under a cover of less than 225 ft. When the depth exceeds 120 ft. two 500-ft. units should be used in tandem. Conveyors similar to this type have been in use at the Lynch mines and are capable of delivering 1,000 tons of coal per hour per conveyor. The mechanical and electrical equipment installed at this mine and also in several other mines is described. — *Coal Age*, Dec. 20, 1923.

Electrophysics, Electrochemistry and Batteries

Electrolytic Reduction of Oximes.—MASAYOSHI ISHIBASHI.—An investigation on the electrolytic reduction of benzoinoxime from which it is concluded that for the preparation the concentration of sulphuric acid in the cathode solution should not exceed 5 per cent and the electrolysis should be conducted at from 19 deg. to 20 deg. with current density of about 0.3 amp. per square centimeter preferably with tin and lead as cathodes.—*Memoirs of the College of Science, Kyoto Imperial University*, Vol. VII, No. 1.

Storage-Battery-Driven Cars.—J. BOES.—The author gives a great many statistical data to show the use of storage-battery-driven cars, both for passengers and trucks, in all the civilized parts of the world. He deplores that in France this type of traction is practically unknown and points to America as the country with the widest use of storage-battery-driven vehicles. Ignorance of actual facts and a great deal of prejudice seem to be the two main reasons why France does not favor that type of vehicle. A number of comparative cost figures for gasoline-driven and electric cars are given. These show considerable saving and advantages for the electric car in every respect as far as urban operation is concerned. — *Revue Générale de l'Electricité*, Dec. 8, 1923.

Traction

Trackless Trolley.—A. CHARDIN.—A traction system using the trackless trolley has recently been placed in service near the Italian frontier in France. The line is 15 miles long with 1,100-ft. elevation difference between start and finish. Two 75-kw. substations transform and rectify 10,000-volt, three-phase current into 550-volt direct current. American 150-amp. glass-bulb mercury-arc rectifiers are being used. The overhead copper wires are of 80 sq.mm. cross-section and are held on steel levers from wooden poles at about the middle of the highway. A constant distance of 14 in. is maintained between the positive and the negative trolley wire. The present rolling stock comprises three passenger cars and three 3-ton trucks. Each car has two 16-kw. motors driving the rear wheels independently with a reduction of one-tenth on the passenger cars and one-fifteenth on the trucks. Two different types of current collectors are being tried out. As the climate is cold 4-kw. electric heaters are installed in each car. The average speed of the cars is 13 miles per hour.—*Revue Générale de l'Electricité*, Dec. 8, 1923.

Telegraphy, Telephony, Radio and Signals

Overvoltage Protection by Electron Tubes.—F. SCHRÖTER.—The extreme simplicity and reliability of operation of an ordinary fuse as a means of protection against overcurrent had until very recently no counterpart in an overvoltage protector which would be operative within or below the usual distribution voltages of 100 to 250. A number of such protectors have lately been developed. They all consist of small electron tubes into which are sealed two or three electrodes in an atmosphere of a rare gas. The critical voltage is determined by the distance of the electrodes, the nature of the electrodes, the nature of the rare gas and the barometric pressure of the gas. By proper choice of the above variables tubes may be built for arc-over voltages of from 90 volts up to 300 volts. These tubes are of particular value for telephone, telegraph and signal systems on account of their low breakdown voltage. — *Elektrotechnische Zeitschrift*, Nov. 15, 1923.

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

Printing Telegraph Systems and Mechanisms

By H. H. Harrison. New York: Longmans, Green & Company.

Considering the increasing importance of the printing telegraph during the last few years, it is surprising that there are not more good up-to-date books on the subject. The one under notice is the first comprehensive work to appear. It is the second of the Longmans series on telephone and telegraph engineering, the first, "Telephonic Transmission," being by J. G. Hill. Both are excellent books and it is to be hoped that others will be published in the near future.

Mr. Harrison, who has had years of telegraph experience, has maintained an active interest in the advances of the art and is thoroughly familiar with the historical phase of the subject. He gives an interesting summing up of the contributions by different engineers which have made possible our modern multiplex printers and also points out that the basic ideas are not of recent origin. In this connection references to original papers, books and other source information would have made the book more valuable to those not familiar with such sources.

The author has developed his subject on the basis of structural elements rather than by describing complete printing-telegraph systems, and for this reason it may not at first appeal to the operating engineer, but a careful study of the book will win his favor. It is a splendid reference book and should be in every communication library. It is filled with information of value to the student and design engineer. The book is well written, fully illustrated and remarkably free from errors.

Der Glimmschutz

By George I. Meyer. 61 pages, 58 illustrations. Leipzig and Berlin: B. G. Teubner.

The book describes the construction, experiences and tests made on an overvoltage-protection device, the principle of which is the artificial decrease of the distance between the line to be protected and ground. At the same time sharp edges are given to the line and the ground terminals to stimulate corona discharge. Glass in the shape of an inverted tumbler is used as a dielectric between the two electrodes. The upper electrode touches the glass for low and medium-voltage models, but is located a certain distance above it for high voltages, in which case the two dielectrics—glass and air—are in series. The device is being built for operating voltages up to 65 kv. The electric capacity of such an arrangement is very low up to the beginning of corona discharge and increases rapidly beyond this critical voltage. This feature makes it very useful as an overvoltage protector, because a considerable amount of current will pass through it to ground in case of an excess voltage on the line, with the added advantage of there being no possibility of the line current following this established path.

Elements of Storage Batteries

By C. M. Jansky and H. P. Wood. New York: McGraw-Hill Book Company, Inc. 241 pages, illustrated.

A good practical book prepared by two Wisconsin University professors as a text in the industrial education series of the extension division of the university. While elementary in character, it is quite complete in discussing types of batteries, internal chemical action, assembly and tests, charging and discharging methods and equipment, battery diseases and battery maintenance. The text is well illustrated, and each chapter has questions and problems which are very good and add greatly to the value of the book as a text. It should fill a demand for a practical and up-to-date text on batteries for schools, colleges, garage men and others working with acid and alkaline batteries.

Continuous Current Circuits and Machinery

Vol. I. By J. H. Morecroft and F. W. Hehre. New York: John Wiley & Sons. 433 pages, illustrated.

A welcome addition to textbooks for students in engineering schools. The electron theory is used as a basis for physical explanations and the explanations are unusually clear and lucid. A thorough treatment of the fundamental principles of the electric and magnetic circuits is followed by an analysis of the more important machines and equipment used in continuous-current engineering. A splendid treatment of batteries is included, nor have the authors neglected electrical equipment for switchboards and automobiles. Problems follow each chapter, and a good series of laboratory experiments is included. The text is well illustrated. The book should become very popular as a college text, although it would be better if the problems had a more practical tinge. Some, too, will question the rather inadequate and artificial treatment of the electrostatic circuit. None the less, the book is a good example of the best type of textbook writing by experienced teachers. A companion volume on alternating-current circuits and machinery is to follow.

Book Notes

Synthetic Resins and Their Plastics. By Carleton Ellis. New York: The Chemical Catalog Company. 500 pages, illustrated.

Extensive data on synthetic products of a resinous character or of an amorphous nature which may lead to their substitution for natural resins. Industrial applications of synthetic resins to varnish making and plastic molding are discussed. The book is of interest to chemists and manufacturers of molded electrical products.

Hydro-Electric Power Stations. By Daniel B. Rushmore and Eric A. Lof. Second edition, revised and reset. New York: John Wiley & Sons, Inc. 830 pages, illustrated.

A complete revision of a very good book on hydraulics and power-station equipment. The new edition contains many statistics and much new material and should be in the libraries of hydraulic engineers and central-station executives. In addition, it affords a splendid text for advanced students.

Alternating Currents, Their Theory, Generation and Transformation. By Alfred Hay. Fifth edition. London: Harper & Brothers. New York: D. Van Nostrand Company. 420 pages, illustrated.

A general account of the principle, construction and use of alternating-current measuring instruments, generators, motors and transforming apparatus. Among the more important alterations and additions in this edition are those concerning the treatment of polyphase commutator motors and the theory of unbalanced polyphase systems, instrument transformers and phase converters.

Verschleierung der Angaben von Elektrizitätszählern und Abhilfe. By A. Geldermann. Berlin: Julius Springer. 126 pages, 109 illustrations.

An exposé of the methods used for theft of energy without interference with the watt-hour meter. The book covers all types of meters, various distribution systems, special circumstances that make theft possible without detection and methods of protection against theft. A multitude of diagrams show every possible connection at a glance.

Design of Concrete Structures. By L. C. Urquhart and C. E. O'Rourke. New York: McGraw-Hill Book Company, Inc. 452 pages, illustrated.

A text on concrete which can be used for the elementary courses given in engineering schools. Several chapters on the theory of reinforced concrete give sufficient information to insure the beginner a thorough understanding of fundamentals. Complete designs of the essential features of the more common concrete structures are then given in order to furnish a vehicle for the bringing together of all the fundamental theory involved.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Hartness Succeeds Cooley

Elected President of F. A. E. S.—Hoover Gives Views on Cabinet Reorganization

AT THE annual meeting of the American Engineering Council of the Federated American Engineering Societies, which opened in Washington, Thursday, January 10, ex-Gov. James Hartness of Vermont, a former president of the American Society of Mechanical Engineers, was elected president, to succeed Dean M. E. Cooley of the University of Michigan.

At an all-day session on Wednesday, participated in by approximately one hundred organizations from all parts of the United States, the national public works conference held under the auspices of the American Engineering Council adopted a resolution favoring a reorganization of federal departments. No particular plan was indorsed, the resolutions embodying the aims of the engineers, architects, contractors and allied bodies merely declaring that "this conference particularly indorses grouping and co-ordinating within an existing department, preferably renamed Department of Public Works, the construction and administration of all non-military public works."

Secretary Hoover's Views

Secretary Hoover of the Department of Commerce, the first president of the engineering federation, who was the chief speaker at Wednesday's meeting, said that no isolated bills for government reorganization could pass Congress and that the problem of regrouping public works functions was inseparably tied up with the larger problem of general reorganization. Segregation of vast public works functions, in his opinion, must be accompanied by parallel segregation of other activities. He also asserted that the creation of a new Public Works Department with a secretary as a member of the President's Cabinet was out of the question.

Executive Secretary L. W. Wallace of the federation said that Secretary Work of the Department of the Interior was in sympathy with the movement to make over the latter department by the creation of a Division of Public Works and a Department of Public Domain.

At the suggestion of Calvert Townley, a past-president of the American Institute of Electrical Engineers, the council went on record as favoring an engineering investigation of the St. Lawrence-Great Lakes waterway before the matter was definitely presented to the American and Canadian governments.

The list of speakers at the annual

Ex-Gov. James Hartness

dinner on Thursday night included Secretary Hoover, Nicholas Murray Butler of Columbia University and Dwight F. Davis, Assistant Secretary of War.

Two Penstocks in California Suffer Accident

A penstock belonging to the Big Creek No. 8 plant of the Southern California Edison Company broke on January 1 after the plant had been shut down for the holiday, and the escaping water caused the death of two women before it was got under control. The cause of the break has not been learned. A break in the same penstock occurred about two years ago, at the time the plant was placed in operation.

On the following day a break occurred in the penstock at the new El Dorado plant of the Western States Gas & Electric Company on the American River while the penstock was being filled for the first time. The break was near the power house, and no serious damage was done except to the pipe itself. The rupture was about 6 in. long and 16 in. to 18 in. from a longitudinal weld and parallel thereto. The escaping water under a head of about 1,800 ft. forced the break open to a width of about a foot. The penstock at the point where the break occurred consists of lap-welded pipe of 30-in. diameter laid in 20-ft. sections.

Kansas City Company Sold

Continental Gas & Electric Adds Big Central-Station Property to Its System

THE Continental Gas & Electric Corporation of Omaha, which controls the Nebraska Gas & Electric Company of that city and which last year acquired control of the Lincoln (Neb.) Gas & Electric Light Company from the Doherty Operating Company, has just purchased the stock of the Kansas City Power Securities Corporation, which controls the Kansas City Power & Light Company. The purchase price is understood to have been $10,000,000, the negotiations having been conducted through the Guaranty Trust Company of New York.

The Kansas City Power Securities Corporation was incorporated in 1921 in Illinois and acquired all the common stock of the Kansas City Power & Light Company, thus acquiring ownership of the latter company's numerous subsidiaries in the public utility field of Kansas City.

The Continental Gas & Electric Corporation was formed under the laws of Delaware in 1912. Besides those already mentioned, it owns and operates other public utility properties in Nebraska, Iowa, Missouri and Manitoba, whose distribution systems cover more than a thousand miles of lines. The company also transmits electricity under contract to a number of towns in which local business is not owned, making the total population served prior to the purchase of the Kansas City Power & Light Company about 237,000.

Recently, as reported at the time in the Electrical World, the Illinois Power & Light Corporation, a consolidation of the Studebaker and McKinley public utility interests, purchased about 30 per cent of the stock of the Kansas City Power Securities Corporation from J. Ogden Armour of Chicago.

N. E. L. A. Commercial Groups to Meet at Cleveland

Cleveland, not St. Louis as previously announced, and February 6 and 7, not February 27 and 28, will be the place and time of the group meetings of the Commercial National Section, N. E. L. A. The meetings will be held in the Hotel Cleveland. On Wednesday, February 6, there will be meetings of the Appliance, Lighting, Power and Transportation Bureaus and the cus-

tomer relations committee at 10 a.m. and if necessary 2 p.m. On Thursday there will be a general meeting at 9:30 a.m. and an executive committee meeting at 2 p.m. This will probably be the last meeting of the executive committee prior to the Atlantic City convention in May.

Engineers on Superpower

Technical Representatives of Commissions and Governors Discuss Subject at Washington

AT A MEETING in Secretary Hoover's office in the Department of Commerce Building, Washington, on January 5, engineers of public service commissions and appointees of governors discussed superpower along the Northeast Atlantic seaboard. Everyone of the ten states from Maine to Maryland was represented except New Jersey.

That the problems involved in superpower are chiefly those of engineering was emphasized by both Secretary Hoover and George Otis Smith of the United States Geological Survey, and it was decided to compile engineering data on load centers and points of interconnection for the various states. Definite questions drawn up by the commission engineers will be sent out by the Department of Commerce, and the close co-operation of all electric public utility companies will be solicited. The engineering investigators are to work as a fact-finding body, the desire being to dissociate the practical phases of superpower from political implications and acquaint the general public with its real meaning and possibilities.

The need of wider interconnection was pointed out in the discussion, particularly with reference to water power, since interconnection makes secondary water power available for use in industry. It was also generally agreed that the development of electricity from the waters of the St. Lawrence is an economic necessity.

While the engineers are at work on the economic phases of superpower and interconnection, another committee made up of lawyers is delving into the legal questions involved. In the near future Secretary Hoover has in mind a meeting of public service commissioners, governors and others interested in the public aspects of superpower at which the engineering and legal reports will be made and acted on.

A. T. & T. Company Ends Most Successful Year

The American Telephone & Telegraph Company ended on December 31 its best year from the standpoint both of earnings and of growth of business. It is estimated that earnings for the year will be about $11.42 a share on $715,454,300 average stock outstanding for the nine months ended September 30. There were over 750,000 new Bell-owned stations put into operation.

Court Doubles Valuation

Federal Judge Declares Commission's Rates for the Colorado Power Company Confiscatory

EVER since December, 1919, the Colorado Power Company has endeavored to obtain an increase of from 20 to 40 per cent in the rates for the energy furnished by it to mining companies and municipalities in northern and central Colorado. This territory contains the Boulder development, the Georgetown development and the Leadville system, all hydro-electric. The company asked 40 per cent increase on average rates and 20 per cent on special contract rates. After repeated failures to obtain a favorable ruling from the Colorado Public Utilities Commission, the company a year ago took the case into the United States District Court at Denver, alleging the present rates to be confiscatory. This claim was sustained on January 4 by Judge J. Foster Symes, who found that the valuation placed by the commission on the company's property is far too low. The judge declared the property to be worth $9,613,325.94, or more than double the commission's figure of $4,211,460. The company had claimed a value exceeding $11,000,000.

The court held that the company had for four years suffered irreparable injury through the commission's refusal to grant the increased rates. It ordered the company, however, to continue to supply power to the consumers who are under contract and upheld the constitutionality of the Public Utilities Commission against the company's plea.

Southern Power Loses

Long Litigation with North Carolina Public Service Company Ends in Supreme Court

THE litigation between the Southern Power Company and the North Carolina Public Service Company over the obligation of the former to sell power to the latter for resale to Greensboro, High Point and Salisbury, N. C., reached its end January 7, when the United States Supreme Court declared through Justice McReynolds that the case presented no issue of vital public importance and dismissed the writ of certiorari sued for by the Southern Power Company without going into the merits of the suit. The court declared that the writ had been granted on a misapplication of the rule and that only questions of fact were at issue.

The Southern Power Company had contended that it could not be forced to sell power for redistribution by the North Carolina company as the latter was in a position to generate power itself if it so desired and that the Southern Power Company should be permitted to take for itself the profit the North Carolina company was getting from the resale. The Southern Power Company won in the District Court but lost in the Court of Appeals, and this decision remains in effect.

The decision means that the Southern Power Company must enter into a new contract with the North Carolina Public Service Company to furnish it whatever power it needs. The Southern Power Company, however, has many requests for energy that it cannot supply, and it is presumed that while the municipal needs of the cities served by the North Carolina Public Service Company must be filed by the Southern Power Company, private patrons of the former company will not be put on the preferred list but must take their turn along with patrons who deal with the Southern Power Company direct or through its subsidiary companies.

(The progress of this litigation in the lower courts was recorded in the issues of the ELECTRICAL WORLD for December 25, 1920, page 1282; July 9, 1921, page 88; January 21, 1922, page 152, and May 27, 1922, page 1088.)

Utility Called a Trust

Suit Is Brought at Nashville Against Tennessee Electric Power and Its Allied Companies

A SUIT of significance to light and power companies in all parts of the nation will come up on Monday next, January 14, at Nashville, when an action brought by the State of Tennessee against the Tennessee Electric Power Company, the Tennessee Power Company, the Tennessee River Power Company, the Chattanooga Railway & Light Company and the Nashville Railway & Light Company, charged with violation of the state's anti-trust laws, will be tried.

It is charged in the bill that these laws were first violated several years ago when the Tennessee River Power Company contracted to sell all its power generated at Hales Bar on the Tennessee River to the Chattanooga Railway & Light Company. It is charged further that the anti-trust laws were violated when the Tennessee Electric Power Company bought the Tennessee Power Company and the Tennessee River Power Company, and again when the Tennessee Electric Power Company contracted to furnish hydro-electric power to the Chattanooga Railway & Light Company and the Nashville Railway & Light Company with the understanding that the steam generating plants of these companies should be used only as auxiliary plants to furnish power when sufficient power for their needs was not available from the hydro-electric plants of the Tennessee Electric Power Company.

DEFENDANTS' DENIAL

The defendant companies in their answer to the allegations of the bill deny that they have violated any of the state anti-trust laws in any contracts made by them. They insist, first, that the anti-trust laws of the state do not and cannot apply to public utility corporations, whose rates are fixed by

the Tennessee Railroad and Public Utilities Commission, making it impossible for the utility companies to agree among themselves on rates to be charged the public.

The answer furthes alleges that, instead of the public being charged more as the result of the contracts, lower rates for electric power have resulted. It is insisted that the contract entered into by which hydro-electric power is to be used when available and steam generating plants to be used only as auxiliary plants is necessary because the hydro-electric power available varies with the stage of the Tennessee River, and that hydro-electric power is cheaper than steam-generated power and in the interest of the consumer should have the preference.

New Offer Made for Muscle Shoals

Nine Electric Power Companies of Alabama, Georgia, Tennessee and the Carolinas Jointly Offer $100,000,000 for the Government Property

A LETTER transmitted to Representative Harry E. Hull of Iowa, member of the House military affairs committee, by the Federal Power Commission, signed by virtually all of the Southern power companies operating in Tennessee, Alabama, Georgia, North and South Carolina, was made public by him this week. The letter indicates the outlines of an offer which these companies are prepared to make, at the government's request, for the utilization and distribution of power from the Wilson Dam at Muscle Shoals, now nearing completion.

The power companies comprise the Tennessee Electric Power Company, the Columbus Electric & Power Company of Columbus, Ga., the Carolina Power & Light Company of North Carolina, the Memphis Power & Light Company of Memphis, Tenn., the Yadkin River Power Company of South Carolina, the Alabama Power Company, the Asheville Power & Light Company of North Carolina, the Central Georgia Power Company of Macon, Ga., and the North Carolina Electrical Power Company. They propose:

1. To organize jointly a power company which shall lease, under the provisions of the federal water-power act, the power plant at Muscle Shoals for a term of fifty years.

2. To pay the government for the power so acquired approximately $100,000,000 during the fifty-year term, including maintenance and repairs, or approximately 4 per cent on the government's investment in power development on the Tennessee River.

3. To provide at cost of production power for use in connection with the manufacture of fertilizer at Muscle Shoals under such terms as Congress may decide.

4. To lease the present Sheffield steam plant at Muscle Shoals, or should the government decide to sell that property, to pay $4,500,000 therefor.

5. To undertake the immediate construction of transmission lines at an estimated outlay of $10,000,000, which will make Muscle Shoals power available to the manufacturing centers of the South, this installation to include the adjacent and intermediate territory of Memphis, Chattanooga, Knoxville and Nashville in Tennessee and various sections in Georgia and South and North Carolina reaching as far eastward as Wilmington, N. C., and ultimately as far southward as New Orleans, Mobile and Pensacola.

6. To lease the power at Dam No. 3 in event the government provides funds for its construction, or at the companies' own expense build the dam as a navigation and power project and operate it under the federal water-power act.

Representative Hull's Comments

Mr. Hull made the following comments on the letter:

"The outline of a proposed tender to the government for the utilization of the power at Muscle Shoals, as made by a group of Southern power companies in response to an inquiry by the Federal Power Commission initiated at my request, is the most practical solution yet advanced for one of the most troublesome problems with which Congress has had to deal.

"Not only does the proposed offer provide for a payment to the government of approximately $100,000,000 during the fifty-year period of the lease, as provided under the federal water-power act, but the interest of the farmer in the potentialities of cheap fertilizer production at Muscle Shoals is thoroughly protected by the reservation of a large block of power, provided under the plan, for such arrangements as Congress may desire to make for manufacture of fertilizer in connection with the nitrate plants. The power not so utilized is thus made available to industry throughout the entire South, from the Carolinas to Louisiana, under the protection and regulation of our established national water-power policy.

"Any fair comparison of the terms of the proposed plan with the Ford offer on Muscle Shoals must serve to show the utter inadequacy of the latter, either from the standpoint of public benefit or of a return to the government on its war-time investment there of $107,000,000. Indeed, from almost any standpoint the Ford offer must now appear of doubtful possible benefit. The new offer would enable the government to realize an adequate return on its investment and at the same time retain Nitrate Plant No. 2 as a standby for war, the only assurance it now has of getting nitrates for explosives if the national safety should make this necessary. The government would retain also other very valuable properties all of which under the Ford offer would be deeded to the Ford corporation for $5,000,000, although it now appears that the government can get $4,500,000 for the Sheffield steam plant alone. The government has sold the Gorgas plant for about $3,500,000, so it can therefore realize $8,000,000 for only two units of the Muscle Shoals properties. Yet Mr. Ford would now pay only about $1,500,000, as suggested by some, for the entire Muscle Shoals plants, which cost originally $107,000,000.

"In another respect the offer enables the government to recover and secure a return on $17,000,000 invested in the power dam during the war. On this Mr. Ford would pay no return and the $17,000,000 would become a total loss.

"It should be pointed out that there is nothing in this plan which would debar Mr. Ford from carrying out his often-expressed desire of doing something for the farmers by the manufacture of fertilizer at Muscle Shoals. The nitrate plants are still available to him, with the necessary power, on whatever terms Congress may decide. I want the government to encourage him or any one else, and afford every opportunity and assistance, in the solution of this most pressing problem with the farmer.

"But if Mr. Ford is to engage in the fertilizer business, employing the resources of the government, it should be under the same guarantees that would be expected or asked of any other man. As chairman of the House committee which visited Muscle Shoals last year and a member of the military affairs committee, which has handled all legislation having to do with nitrate production for war purposes and for fertilizer since the passage of the national defense act in 1916, I have given time and study to this important problem.

Three Fundamental Conditions

"In any disposition of Muscle Shoals I regard these conditions as fundamental: first, the maintenance of the plants as preparedness against war; second, their utilization so far as practicable in time of peace for production of fertilizer, and, third, the distribution of the power not so used to the public under regulations which will insure an adequate return on the investment in the power development.

"Last year I prepared a resolution which, if adopted, would secure these results. I shall reintroduce it to conform to conditions that now exist and will urge its adoption. I believe it will solve this whole question to the satisfaction of every one who desires that the government and the public secure the greatest benefit from the enormous investment of public funds at Muscle Shoals.

"No one knows whether Mr. Ford still desires Muscle Shoals. I endeavored without success to ascertain in what

manner he is willing to modify his offer to meet the new conditions. If he desires to make fertilizer for the farmer, the resolution I shall propose would enable him to lease the nitrate plants on most favorable terms and to secure power for that purpose at an extremely low cost. The power that he may desire for his own operations can be had on the same basis as any other industrial user can have it. The government would thus retain ownership in extremely valuable properties upon which it can certainly recoup a very large amount of its war investment, which is not possible under the Ford offer."

Public Ownership Advocates and Erickson Bill

Advocates of public ownership and control of water-power development in the State of Washington are likely to bury their differences and get behind the Bone and Erickson bills. At a recent meeting in Seattle of friends of municipal exploitation from all parts of the state the Reed bill, a referendum measure to go before the voters this year, was opposed, and the Bone bill, a proposed initiative measure, indorsed. As already told in the ELECTRICAL WORLD, the former calls for a 5 per cent gross tax upon power sold by municipalities outside their corporate limits and the latter for its unrestricted sale. A special committee appointed by the Seattle meeting, with J. D. Ross, the city's Superintendent of Lighting, as chairman, later agreed on a report indorsing also the Erickson bill with minor amendments.

The Erickson measure, which is backed by the Washington Superpower League, provides for the creation of power districts similar in organization to port districts. These districts can include one or more counties or only municipalities. Each district will have three salaried commissioners, the salaries rating according to population from $500 a month downward. The districts are authorized to make a mileage levy, issue bonds and acquire hydro-electric power sites or transmission and distributing lines.

Amendments to the bill recommended by the committee provide for units smaller than the county for public power development districts and exempt municipally owned plants from condemnation under the sections of the bill which provide for a state-wide public power development. These amendments, Councilman Oliver T. Erickson, author of the bill, says, do not affect the principle on which the measure is based. The provision exempting the present municipal plants from condemnation under the proposed bill was adopted as a result of charges that the state-wide power project was an attempt of Seattle to unload the Skagit plant.

Financing in Last Month of 1923 Heavy

ELECTRIC light and power public utility issues of stocks and bonds offered during the month of December amounted to $119,446,000, a total representing an increase of more than $23,000,000 over March, which had been the banner month of 1923. The offerings were not only large in volume but also in number, twenty-eight utilities having participated in the month's financing. These securities—practically all long-term—yielded an average return of 6.50 per cent to the investor, as compared with 6.49 in November and 6.25 in October. The largest single offering was the $38,400,000 issue of preferred stock of the American & Foreign Power Company, Inc., the organization recently formed by the Electric Bond & Share Company.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN DECEMBER

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Georgia Railway & Power Co.*	$1,400,000	..	First preferred cumulative stock		8	104	7.69
Arizona Power Co.	400,000	24	First lien and unifying mortgage gold bonds, series A	Refunding and to reimburse	6	92	6.70
Ottawa River Power Co., Ltd.	3,250,000	30	First mortgage sinking-fund gold bonds, series A	Construction	6½	100†	6.50
East Penn Electric Co.	467,500	..	First preferred stock	To reimburse, acquire stock of other companies and construction	7	93½	7.50
Southern Public Utilities Co. (N. C.)	4,000,000	20	First and refunding mortgage gold bonds of 1913	To reimburse	5	91½	5.75
Community Power & Light Co. (Mo.)	1,718,000	10	First mortgage collateral sinking-fund gold bonds, series C	Acquisition of properties and extensions	6½	98	6.80
Kansas Power Company	500,000	10	Sinking-fund gold debenture bonds	To reimburse and for additions and improvements	7	99½	7.07
Missouri Power & Light Co.	3,000,000	20	First mortgage and refunding general sinking-fund gold bonds, series A	For acquisition of properties and securities and refunding	7	99½	7.04
Northern States Power Co. (Minn.)	8,500,000	25	First lien and general mortgage gold bonds, series A	To reimburse and for acquisition of properties free from lien	6	97½	6.20
Philadelphia Suburban Gas & Electric Co.	3,650,000	20	First and consolidated mortgage gold bonds	Improvements and to reimburse	6	96½	6.30
Cumberland County Power & Light Co. (Me.)	233,000	19	First and refunding mortgage gold bonds of 1912	Additions	5	89½	5.90
United Light & Railways (Me.)	1,000,000	29	First lien and consolidated mortgage gold bonds, series A	To reimburse	6	95	6.38
Binghamton Light, Heat & Power Co. (N. Y.)	475,000	23	First refunding mortgage gold bonds of 1916	Additions	5	88½	5.93
City Light & Water Co. (Tex.)	1,000,000	3	First mortgage gold bonds	Refunding and other corporate purposes	6	97.84	6.80
Metropolitan Edison Co. (Pa.)	1,209,000	..	Cumulative participating preferred stock	Additions	7	93	7.52
Oklahoma Gas & Electric Co.	2,500,000	18	First and refunding mortgage gold bonds, series B	Additions and extensions	6	92½	6.70
Rochester Gas & Electric Co.	4,000,000	25	General mortgage gold bonds, series C	Extensions	5½	95½	5.85
Ohio Power Company	2,000,000	30	First and refunding mortgage gold bonds	Additions	6	98½	6.11
American Gas & Electric Co. (N. Y.)	3,500,000	91	Gold debenture bonds (American series)	To reimburse and other corporate purposes	6	95	6.30
Commonwealth Edison Co.	15,000,000	30	First mortgage collateral gold bonds, series A	To reimburse	5	92½	5.50
Northern New York Utilities, Inc.	1,183,000	20	First lien and refunding bonds, series C	Construction	6	99	6.10
Northwestern Public Service Co.	1,900,000	25	First mortgage gold bonds, series A		6½	98	6.65
West Penn Power Co.	7,500,000	30	First mortgage gold bonds, series F	Additions	5½	95½	5.85
American & Foreign Power Co., Inc.	38,400,000	..	Preferred stock		7	96	7.29
Adirondack Power & Light Corp.	850,000	27	First and refunding mortgage bonds	Additions	6	99	6.07
Public Service Co. of Northern Illinois	10,000,000	39	First lien and refunding mortgage gold bonds, series A	Refunding, to acquire property and other corporate purposes	5½	92	6.05
General Gas & Electric Corp. (N. Y.)	710,500	..	Cumulative preferred stock, class A	Additions	8	101½	7.85
Michigan Gas & Electric Co.	1,100,000	20	First mortgage and refunding gold bonds, series A	Refunding, to reimburse and other corporate purposes	6	91½	6.79
Portsmouth Power Co. (N. H.)	1,400,000	22	First mortgage lien and refunding gold bonds, series A	Refunding and additions	6	97½	6.21
Total	$119,446,000						

* A November offering; issued too late to include in November total. † Carrying a bonus of two and one-half shares of common stock of no par value with each $1,000 bond.

Injunction to Be Sought

Power Commission Will Proceed Against Girand—Tidal Power Project—New Chattahoochee Plan

THE Department of Justice has before it a request from the Federal Power Commission to seek as promptly as possible an injunction requiring James B. Girand to discontinue construction work on his project at Diamond Creek on the Colorado River. As stated last week, Mr. Girand holds a license from the State of Arizona which would have expired on Dec. 26 had he not begun this work, but the commission is withholding its license in the hope that a general policy may be agreed to by all the states in the Colorado River basin before any licenses are issued by the federal government.

To Get Energy from the Tide

The first application to reach the commission proposing any development of power by using the tide has just been filed by Dexter P. Cooper, a brother of Hugh L. Cooper. His application covers a project on the Bay of Fundy, near Eastport, Maine, calculated to develop about 400,000 hp. The project involves the construction of five miles of dams. Some sections of the dams will have to be built in water more than 200 ft. deep. One dam will connect the mainland of Canada with Deer Island; another will connect Deer Island with Porto Bello Island, while a third will cross Lubeck Channel to the mainland of Maine. Another dam will run directly from Deer Island to the Maine coast and divide the development into upper and lower pools. The power house is to be installed between the two pools.

The upper pool will receive its water from the St. Croix River. It is to be equipped with gates so as to permit the entry of water at high tide into the upper pool. At floodtide these gates will be closed. The lower pool is to be emptied as the tide ebbs and will be closed as the tide turns. The range of the tide at this point is in excess of 30 ft. By the operation of these pools Mr. Cooper calculates that a flow of some 200,000 cu.ft. per second can be assured. A head varying from 16 ft. to 27 ft. can, he says, be obtained.

New Chattahoochee Project

Stone & Webster, acting for the Columbus Electric Company of Columbus, Ga., have filed a declaration of intention with the commission covering a 120-ft. dam in the Chattahoochee River at a point 18 miles above Columbus. It is proposed to develop 40,000 hp. at that point, and the plans include an ultimate development of 80,000 hp. The proposed dam will create gross storage to the extent of 200,000 acre-feet. It is planned to use the upper 100,000 acre-feet as live storage.

The declaration has been referred to the Chief of Engineers to ascertain the probable effect of such a development on navigation in the lower stretches of the river. Columbus is the present head of navigation. There are several smaller dams between Columbus and the proposed development, but since this project contemplates such a large amount of storage, it is believed probable that the federal government will take jurisdiction.

Other Projects

The Chief of Engineers holds that the Wabash River in Indiana is a navigable stream at least as far up as Logansport, notwithstanding the fact that there are many fixed bridges below that point. He therefore recommends that the commission take jurisdiction over the project of John A. Shaffer, who proposes to construct a dam 6 miles below Logansport.

The staff of the commission has declined to act on the application of the Imboden Hydro-Electric Company covering a project on Spring River in Arkansas until a more complete statement is forthcoming as to the financial plans of the company.

The American Aluminum Corporation of New York is proposing a large mining development in the Alum Mountains on the Gila River in western New Mexico and has applied for a right to develop 2,000 hp. at a point near Silver City.

Charles Page of Sand Springs, Okla., has declared his intention to construct a 5,000-hp. project on the Arkansas River near the boundary between Oklahoma and Arkansas. It is regarded as probable that the Federal Power Commission has no jurisdiction over this project.

Italian Ambassador Visits the Westinghouse Plant

Prince Gelasio Caetani, Italian Ambassador to the United States, was recently the guest of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa. During his visit the Ambassador, who was welcomed by President E. M. Herr, inspected the principal works and the high-voltage laboratory of the company, where spectacular electrical phenomena were produced in his honor. A million-volt arc, the largest controlled arc ever made artificially, was flashed through a distance of 42 ft. Flashover tests were made of Westinghouse insulators, with voltages ranging from 600,000 to 800,000. The high-voltage line running to the Westinghouse laboratory and carrying 220,000 volts is stepped up to 1,000,000 volts inside the laboratory by a 1,000,000-volt transformer, the only one of its kind in the world.

H. W. Cope, assistant director of engineering of the Westinghouse Electric & Manufacturing Company; Prince Gelasio Caetani, Ambassador to the United States, and S. M. Kintner, director of the Westinghouse research laboratory, standing before the million-volt transformer.

Utility Commissioners of New Jersey Ask More Power

Legislation permitting the Board of Public Utility Commissioners of New Jersey to apply directly to the Court of Chancery for appointment of a receiver for any public utility which refuses to provide service to the public is recommended by the board in its annual report, submitted to Governor Silzer.

The report points out that last summer, during the strike of Public Service Railway Company employees, the board ordered the company to resume operations, and it had thirty days in which to appeal the order to the Supreme Court. The company did not file an appeal until the end of the thirty-day period, when the board was compelled to wait until the Governor had ordered the Attorney-General to apply for an injunction against the company. The report recommended that the period of time for filing an appeal be reduced to five days after the issuance of the order.

The report asked that the present $100 daily fine for any company which fails to heed the board's order for immediate resumption of operations be increased to $1,000 daily.

West Penn Purchases Clarksburg Gas & Electric

Purchase of the Clarksburg (W. Va.) Gas & Electric Company, which supplies light and power in Clarksburg and surrounding territory, has been announced by the West Penn Company. This company has started to build two transmission lines into Clarksburg, which will connect the newly acquired property with the generating stations of the West Penn system at Beech Bottom and Rivesville, W. Va., and Connellsville and Springdale, Pa., making the property a part of the superpower system controlled by the American Water Works & Electric Company, extending from near the southern boundary of New York through western Pennsylvania, northern West Virginia and, with the allied Potomac Edison Company, across Maryland to the outskirts of Baltimore.

Briefer News

Dallas Electrical Club.—J. B. Thomas was elected president of the Dallas Electrical Club at the annual meeting and George T. Brundrett vice-president. Beeman Fisher was re-elected secretary and W. R. Burns treasurer.

Atlanta Electrical Association.—This body has elected the following officers for the coming year: President, A. G. Stanford; vice-president, R. H. Scott; secretary, W. W. Barr; treasurer, L. H. Palmer. The executive committee is composed of the officers and C. L. Emerson, P. C. Gilham and John Shaw.

North Carolina Contractors Organize.—Electrical contractors and dealers of North Carolina met at Charlotte on Saturday, January 5, and organized a state association. M. L. Walker of Raleigh was elected president and F. E. Robinson of Charlotte secretary. About fifty men were present.

Southeastern Division, N. E. L. A. Edward T. O'Connell and S. A. Fletcher, both with the Alabama Power Company, have been elected secretary and treasurer respectively of this division in succession to Charles A. Collier and C. J. Plemming. Mr. Fletcher has been chairman of the meter committee for several years.

Madison, N. J., Discontinues Municipal Plant.—The City Council of Madison, N. J., has arranged with the Central Jersey Power & Light Company for a reduction on the lighting rate from 12½ cents to 10 cents per kilowatt-hour. The city contracted with the central-station company for service last fall and has discontinued its municipal plant.

New York Edison Buys Another Power House.—The First Avenue power house property of the New York Railways Company has been sold in foreclosure proceedings to the New York Edison Company at the upset price of $800,000. The plant will, it is understood, be modernized and used as a power plant by the Edison company.

Mississippi Consolidation Complete.—The completion of the Mississippi Power & Light Company has been effected with the consolidation of the public utilities properties at Vicksburg, Jackson, Columbus and Greenville, C. R. Couch of Jackson becoming active vice-president and general manager. A transmission line from Jackson to Clinton and other extensions.

New Steam Turbine for Eureka, Cal.—Work is nearing completion on the steam turbine being installed by the Western States Gas & Electric Company at Eureka, Cal. The new unit is a 5,000-kw. Westinghouse turbine, and in addition to the auxiliaries the installation will include new boiler equipment. This addition to the plant capacity has been made necessary by the rapid growth of load in this division.

Pacific Gas & Electric Company to Purchase Small Properties.—The Pacific Gas & Electric Company desires to purchase the plants and properties of the Amador Electric Light & Power Company, the Sutter & Amador Water Company and the Ione Water Company. The properties are in the mining district about 50 miles northeast of Stockton, Cal.

Sale of Power Site to Alabama Power Company Attacked.—The sale by the State of Alabama to the Alabama Power Company for $100,000 of the power site at Buyck's Farm has caused much criticism from citizens who assert that this was the last available good water-power site in the state and that its sale gives the power company a monopoly of hydro-electricity. The site had been held with the idea of establishing a state plant there to furnish power to public institutions.

New England Metermen to Hold Two-Day Convention.—Under the auspices of the Meter Bureau, New England Division, N. E. L. A., a convention will be held at Lynn and Boston January 16 and 17, with opportunity for inspecting the Lynn meter factory of the General Electric Company on the first day and with a question-box discussion of metering problems on the second day at the service buildings of the Edison Electric Illuminating Company of Boston. Engineers and sales experts from leading manufacturers of meters instruments and testing equipment are expected to take part.

Northern Illinois Company's New Rate Cut.—On January 1 the Public Service Company of Northern Illinois put into effect a further reduction of 1 cent per kilowatt-hour in the initial portion of its rate A, "general lighting service," in accordance with the order of the Illinois Commerce Commission issued last summer. This is the second reduction in the electrical energy rates of this company within five months, one having become effective on August 1 last, and the seventh reduction since the company's organization in 1911.

Two Great Beacon Lights.—A beacon manufactured by a Paris company which diffuses a volume of light over a distance of a half mile in every direction has just been installed at Mitchell Field, Long Island, N. Y., to aid aviation and facilitate night flying. The beacon is the size of a hogshead—4 ft. high and about 3 ft. in radius. It is rated at 5,000,000 cp. and 120 amp. At South, Bend, Ind., a 4,000,000-cp. beacon has been installed at the Studebaker automobile works which will burn every night and all night for the guidance of motorists and aviators. South Bend is on the air mail route between New York and Chicago.

Wood Preservers to Meet in Kansas City.—At the twentieth annual meeting of the American Wood Preservers' Association, to be held at the Hotel Muehlebach, Kansas City, January 15-17, problems in the treatment of timber and advanced practices in analyzing and employing preservation will be discussed. The tentative program includes these papers: "Effect of Steam Treatments and Temperatures on the Penetration of Zinc Chloride," by J. D. MacLean; "Low-Temperature Tars," by R. P. Soule; "Visible Determination of Penetration of Sodium Fluoride in Treated Wood," by H. A. Geauque; "Theory on Mechanism of Protection of Wood by Preservatives," by Ernest Bateman.

Another Deerfield River Development Contemplated by New England Power Company.—Engineering designs for a new hydro-electric generating plant at Sherman Bridge, Vt., on the Deerfield River, are being prepared by the New England Power Company of Worcester, Mass. The plans are for a station of about 6,000 kw. rating operating under a head of about 70 ft. and run under remote control from the new plant at Davis Bridge. It has not been decided when construction work will be started, but the location of the proposed plant is of interest in view of the fact that its headworks and forebay will be supplied with tailwater from Davis Bridge, the tailwater from Sher-

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published in the first issue of each volume. See January 5 issue, page 72, for latest list.]

Wisconsin State Association of Electrical Contractors and Dealers—Pfister Hotel, Milwaukee, Jan. 17-19. H. M. Northrup, 23 Erie Street, Milwaukee.

National Association of Lighting Equipment Dealers — Hotel Sherman, Chicago, Jan. 21-26.

American Society of Safety Engineers—Engineering Societies Building, New York, Jan. 22.

Technical National Section, N. E. L. A.—Birmingham, Jan. 28-Feb. 1.

Western Association of Electrical Inspectors—Hotel Fontenelle, Omaha, Jan. 29-31. W. S. Boyd, 175 West Jackson Blvd., Chicago.

Iowa Engineering Society—Montrose Hotel, Cedar Rapids, Jan. 29-Feb. 1. R. H. Freese, Cedar Rapids.

American Institute of Electrical Engineers—Midwinter convention, Bellevue-Stratford Hotel, Philadelphia, Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

Commercial National Section, N. E. L. A.—Hotel Cleveland, Cleveland, Feb. 6-7.

American Physical Society — New York, Feb. 23.

American Institute of Electrical Engineers—Spring convention, Birmingham, Ala., April 7-11. W. E. Mitchell, Alabama Power Co., Birmingham.

Wisconsin Utilities Association — Hotel Pfister, Milwaukee, April 17-18. John N. Cadby, 445 Washington Bldg., Madison.

American Electrochemical Society—Hotel Bellevue-Stratford, Philadelphia, April 24-26. C. G. Fink, Columbia University, New York.

Nebraska Section, N. E. L. A.—Omaha, May 8-9. H. M. Davis, Bankers' Life Bldg., Lincoln.

National Electric Light Association—Atlantic City, N. J., May 19-23. M. H. Aylesworth, 29 West 39th St., New York.

man Bridge being discharged into the headworks and forebay of the No. 5 station near the Hoosac Tunnel.

Low Power Rate Proposed in Seattle to Attract New Industry.—Reduction of the rate for electric power for large loads has been recommended to the Seattle City Council by Superintendent of Lighting Ross, who suggests that the rate ordinance be amended to permit contracts at a rate of $25 a kilowatt a year for firms using 1,000 hp. or more. The proposal is the result of negotiations of the light department with representatives of the Pacific Nitrogen Company to bring its plant to Seattle. Superintendent Ross takes the position that with the Skagit plan nearly completed the city can give a low rate on surplus power and promote industrial development.

January 16 to Be "Industrial Safety Day" in New York.—Governor Smith of New York has designated January 16 as "Industrial Safety Day" in that state, and it is hoped then to center attention on the necessity for reducing the economic waste and suffering caused by accidents. Arthur Williams of the New York Edison Company, chairman of the committee of employers, labor leaders, educators and civic workers co-operating with Bernard L. Shientag, State Industrial Commissioner, in the movement, is quoted as saying that industrial accidents and deaths have been on the increase in New York each year and that more than one thousand workers are now injured in that state every working day in the year.

Maryland Companies Are Merged.—Consolidation of the Potomac Edison Company and the Potomac Service Company into a new corporation to be known as the Potomac Edison Company has just been effected, according to an announcement made by the American Water Works & Electric Company, of which the companies consolidated are Maryland subsidiaries. They have 35,000 consumers and estimated gross earnings in excess of $3,600,000. The new corporation will serve the entire territory formerly served by the consolidating companies, embracing central and western Maryland and adjacent regions in northern Virginia, West Virginia and southern Pennsylvania. Emory L. Coblentz is the chairman of the board of the new corporation and M. F. Riley is president.

San Francisco Demands Appraisal of Power Lines. — The Board of Supervisors of San Francisco has, by a vote of thirteen to two, asked the California Railroad Commission to place valuations on the power distributing properties of the Pacific Gas & Electric Company and the Great Western Power Company in the city, with a view toward their ultimate acquisition for disposal of Hetch Hetchy hydro-electric power. Supervisor McLeran strongly opposed the resolution. "Within sixty days this board will be forced to ask the voters to approve of a bond issue to complete the Hetch Hetchy project," he said. "It will cost $4,000,000 more to complete the power end of the work. The Pacific Gas & Electric Company has 25,000 stockholders in this city, and if you are going to ask them to vote bonds after you have acted to condemn their holdings, you will be defeated."

Indiana Public Utility Association.—The annual meeting of this association will be held January 15 and 16 at the College of Engineering of Purdue University. The program will include a series of lectures arranged by the Purdue engineering faculty on late developments in the utility field. "Can Coal Be Burned Without Smoke?" will be discussed by Prof. G. A. Young, head of the school of mechanical engineering; Prof. W. K. Hatt, head of the civil engineering school, will speak on "Transportation Problems"; Prof. D. D. Ewing, in charge of electric railway engineering, will lecture on "Electrolysis," and "Extra-High-Voltage Transmission" will be the subject of Prof. C. F. Harding, head of the school of electrical engineering, who will follow his remarks with a demonstration of a 600,000-volt transmission line. The regular program of the association will include talks by President E. C. Elliott of Purdue and Dean A. A. Potter of the Engineering College.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Elihu Thomson Awarded Kelvin Medal

Dr. Elihu Thomson, consulting engineer with the General Electric Company, has recently been awarded the Kelvin gold medal, one of the highest honors bestowed in recognition of scientific achievement. The medal, which

ELIHU THOMSON

was founded in 1914 by British and American engineers and is awarded triennially by the presidents of the representative British societies, has been awarded only once before, Dr. W. C. Unwin being the first recipient.

In technical and scientific circles Dr. Thomson has attained a position of eminence as a scientist, inventor and educator, especially because of his achievements in the field of electrical engineering. A Briton by birth, Dr. Thomson came to this country when five years of age and lived and was educated in Philadelphia. He began his research work while holding the professorship of chemistry and mechanics at the Central High School, from which he had been previously graduated, and it was during this period that he laid the foundation of later inventions. In 1880 he resigned his chair at the Central High School to become head of the American Electric Company, which was subsequently reorganized at Lynn, Mass., and named the Thomson-Houston Electric Company. In 1892 the business was merged with the Edison General Electric Company to form the present General Electric Company, and since that time Dr. Thomson has been retained as consultant.

The seven hundred patents issued to him by the United States are a monument to his inventive work, which has extended to almost every field of electrical application. Dr. Thomson has previously been honored by scientific and professional societies and has served as president of the American Institute of Electrical Engineers and of the International Electrotechnical Commission. He was the first recipient of the Edison medal.

J. P. Dolan, who had been connected with the engineering division of the Northern Texas Electric Company, Fort Worth, Tex., has been transferred to the Eastern Texas Electric Company, Beaumont. Both these properties are under Stone & Webster management.

Frederick Mort has been appointed local superintendent for the Central Jersey Power & Light Company at Summit, N. J., succeeding Harry F. Taylor, resigned. Mr Mort has heretofore been connected with the Westinghouse Electric & Manufacturing Company.

M. J. Daley, for a number of years manager of the electrical department of Fred T. Ley & Company, Inc., in Springfield, Mass., has severed his connections with this company and has opened offices there to specialize in transmission-line and substation engineering and construction.

Robert L. Eltringham Joins N.E.L.A. Staff

Robert L. Eltringham, formerly manager of the California Electrical Co-operative Campaign, has joined the staff of the National Electric Light Association as assistant to M. H. Aylesworth, managing director, succeeding S. A. Sewell, resigned. Mr. Eltringham, who is a native of Pennsylvania, has long been identified with electrical interests.

After a short connection with the Cramp Shipbuilding Company and later with the electrical department of the Baldwin Locomotive Company, he went to California in 1901. The year 1906

R. L. ELTRINGHAM

found Mr. Eltringham with the Commonwealth Edison Company in Chicago, but two years later he returned to the Coast to take charge of the electric power work of the Empire Construction Company. He served as industrial power engineer of the Great Western Power Company from 1910 to 1914, when he became electrical engineer of the California Industrial Accident Commission, which position he retained until in 1921 he was made manager of the California Electrical Co-operative Campaign. Mr. Eltringham is a member of the American Institute of Electrical Engineers and the Illuminating Engineering Society.

R. C. Barton, formerly connected with the Tennessee Power Company, is now chief engineer of the Iowa Service Company at Missouri Valley, Iowa.

J. A. Whitlow of Pine Bluff, Ark., has become associated with the Public Service Company of Oklahoma as manager at Tulsa.

E. D. Miller, formerly assistant superintendent of the Greensburg district of the West Penn Power Company, has been made superintendent of the Latrobe district of the company, succeeding H. E. Gregory, recently transferred to Greensburg.

E. J. Kirkpatrick, who has been connected with the Marion office of the Indiana General Service Company, has been transferred to Muncie to take over the duties of R. F. Mullin, formerly commercial manager there, recently sent to the Elwood office.

H. E. Gregory, formerly superintendent of the Latrobe district of the West Penn Power Company, has assumed the duties of superintendent of the Greensburg district, having general charge of all construction work and maintenance of physical property in the division.

Charles B. Richardson, formerly of Athens, Ohio, has recently entered the commerce department of the Monongahela West Penn Public Service Company, at Fairmont, W. Va. Mr. Richardson was formerly connected with the state administration of Ohio in supervising electrical installations in different state institutions.

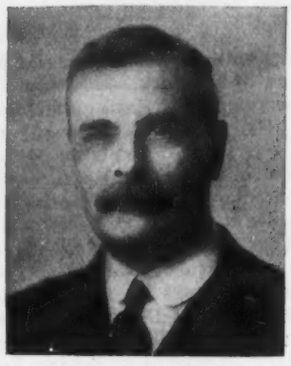
J. S. Street, district engineer of the Alabama Power Company at Selma, has been made district superintendent of the company at Tuscaloosa. The Tuscaloosa Railway & Utilities Company was recently acquired by the Alabama Power Company.

R. W. Lamar, manager of the power department of the Monongahela West Penn Public Service Company, has resigned. Mr. Lamar, who is a graduate of Washington University, St. Louis, in electrical engineering, has been identified with the West Penn system for the past five years. He was previously connected with the Washington Water Power Company, the Electric Bond & Share Company and the Middle West Utilties Company.

Christopher T. Chenery, formerly executive engineer with Sanderson & Porter, engineers and public utility operators of New York, has opened offices in New York City. Mr. Chenery has had a varied engineering experience covering many sections of the United States and some sections of Alaska and Canada. As an executive engineer for Sanderson & Porter and their affiliated operating companies he has handled for them important negotiations involving franchises, rates, municipal-ownership and customer-ownership problems of utility companies and has participated in many investigations and reports for corporate financing purposes. Mr. Chenery and his associates will pay particular attention to financial, rate, franchise and marketing problems and to the purchase and sale of utility properties.

Bernard M. Drake, British Consulting Engineer

Bernard Mervyn Drake, member of the firm of Drake & Gorham, Ltd., electrical, mechanical and hydraulic engineers, London, received his training as a mechanical engineer at the works of Sir Joseph Whitworth in Mancester. In 1881 he became associated with the Anglo-American Brush Company and was sent by it to Spain in connection with the lighting of the Buen Retiro at Madrid. Later he went to Lisbon. After serving as engineer with the Brush Midland Company he became engineer of both the Great Western and Brush Midland sub-companies and



B. M. DRAKE

had charge of the early central stations erected at Bristol, Cardiff and Cleethorpes. In 1884 he was appointed managing engineer of the Electrical Power Storage Company, with which he remained two and a half years. In 1886 he went into partnership with J. Marshall Gorham and founded the well-known firm of Drake & Gorham, which has carried out some of the largest self-contained installations in existence. In June, 1901, the firm was converted into a limited liability company, of which Mr. Drake is chairman and joint managing director. In addition, he is chairman of the Tudor Accumulator Company, Ltd., and chairman and managing director of the D. P. Battery Company, Ltd. Mr. Drake was born in Malta in 1858, and was educated at Rossall School.

Obituary

Charles R. Dougherty, for the past three years working in the financial interests of the General Electric Company on the Pacific Coast, died Nov. 27 at his home in Pasadena, Cal., at the age of fifty-one. Mr. Dougherty began his business career when seventeen years of age with the Thomson-Houston Electric Company in Philadelphia, which he served in a clerical capacity. Later he became cashier of the Philadelphia office and, in 1894, was made auditor of the Philadelphia district of the General Electric Company. In 1913 he was transferred to Schenectady as a general assistant to the comptroller of the company, but in 1920 his failing health necessitated his going to California.

Walter R. Dame, widely known in New England as a corporation lawyer and promoter of electric utilities and traction lines in central Massachusetts and Vermont, died recently at Daytona, Fla., at the age of sixty-three.

Commission Rulings

Deposits Exacted from Power Customer for Construction Costs Found Unjust and Discriminatory.—The Keystone Coal Company complained to the Pennsylvania Public Service Commission that it had applied for and was granted service by the Citizens' Light, Heat & Power Company upon making deposit for construction under a rule alleged to be part of the company's tariff on file with the commission; that during construction the company altered its plans by increasing the voltage of its line from 2,200 to 6,600, thus adding to the estimated cost, and that demand was made upon complainant for payment of this increased cost. The complainant paid the first power bill rendered under the contract and tendered payment of future power bills, which was not accepted, the company alleging non-compliance with contract, and in addition to the amount of the bills certain penalties were demanded. The evidence disclosed that the rule requiring deposit for construction was not part of the company's filed tariff, and the commission held that the application thereof against complainant was unjust, unreasonable and discriminatory and directed service to be continued.

Severance Damages.—For the purpose of determining whether or not any deduction should be made in expenses on account of the burden, if any, placed upon the consumers of the Southern California Edison Company outside the city of Los Angeles by reason of the severance and sale of the distributing system in Los Angeles to that city, for which the company was compensated in the sale price, the California Railroad Commission analyzed the effect of the severance upon the Edison system, concluding: "It appears to us, from an analysis of the evidence, that the severance which was estimated as resulting from idle plant has not occurred and that the public outside of Los Angeles is not burdened as a result. As to the other item of severance damage, or rather increased cost resulting from the sale, full deduction through adjustment to general expense has been made. In view of this no further deductions will be made."

Construction in Advance of Immediate Needs.—In the California Railroad Commission's hearing to fix rates for the Southern California Edison Company a contention was raised that the commission should deduct from the rate base a portion of the company's investment in hydro-electric development because of the construction of several units for a larger capacity than the present needs. On this point the commission said: "It was necessary to decide in the beginning if it would be more economical to construct tunnels for the proposed use or only to provide capacity for the present requirement. The testimony indicated that these conditions have been given consideration and that the construction program as carried out was executed after careful study and should result in a saving to both the company and the consumers. The question of overdevelopment is one of reasonableness. No growing system can or should be constructed so that it is just sufficient to serve the existing consumers with no margin of capacity. Transmission and distribution systems are subject to increased loading and have in a rightly operated system some excess capacity for growth. Similarly canals for ultimate capacity should be constructed, if economical, though not necessary at the present time. Unless the actual construction cost is excessive, due to lack of foresight or unnecessary expenditure, or the overdevelopment is relatively large considering the property as a whole, deduction does not appear justified. Consideration should be given, however, in connection with the determination of the reasonable rate of return, where temporarily an overdevelopment in excess of normal exists."

Recent Court Decisions

Reproduction Method of Valuation Best in Case of Small Utility.—Denying a petition for rehearing in Okmulgee Gas Company vs. Oklahoma Corporation Commission, the Supreme Court of Oklahoma remanded a rate-fixing order to the commission with directions to proceed in accordance with the views expressed by the court, which held that, as a general rule, to determine the present fair value of a small public utility property, upon which it is entitled to a return, what it would cost to reproduce the property less accrued depreciation is the safest and most certain method. The equitable rule, the court continued, is to give due consideration to the history and circumstances under which the utility property was created and the prevailing prices of material and labor at the time of the investigation, and determine the fair average price of materials and labor necessary for the reproduction of the property. Pursuant to this method and the application of sound judgment and common sense, impartial tribunals will discharge the duty in the ascertainment of such values so as to insure the public utility a fair return upon the present value of its property and the patrons a reasonable rate for the services rendered. (220 Pac. 28.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

To Order Extension of Service Where a Company Has No Franchise Is to Take Property Without Compensation.—Hollywood Chamber of Commerce vs. Railroad Commission of California, an action to compel the commission to take jurisdiction and hear a complaint in which the petitioner asked the commission to order the Los Angeles Railway Corporation to extend certain street-car lines into territory where it has no franchise, has been dismissed by the Supreme Court of California, which says the duty of the company is limited by its franchises and that to compel it to extend its lines in the manner asked would be to take private property without compensation. Any attempt in the public utilities act to confer such jurisdiction is, the court holds, unconstitutional. (219 Pac. 983.)

Insurer's Liability Under Workmen's Compensation Act Limited to Terms of Contract.—One Hutchinson, an employee of the Bangor Railway & Electric Company, was killed while inspecting wires for a new installation at the company's hydro-electric plant, and the Industrial Accident Commission of Maine awarded damages to his widow under the workmen's compensation act of the state. The award was contested by both the employing company and the employer's insurer on the ground that the employer had elected to come under the compensation act merely as to a certain job, "plan 3083," while the decedent had been employed in a different job, numbered 3082. The Supreme Judicial Court of Maine has upheld this contention and recommitted the case, declaring that a compensation insurance carrier cannot be held beyond the terms of its contract of indemnity. (122 At. 626.)

Does Approval of Engineer Mutually Agreed Upon Bind Owner of Dam to Pay Contractor for Work Held to Be Faulty?—In determining a claim made by F. E. Marsh & Company for balance due on a contract for the construction of a dam and power house for the Light & Power Company of St. Ansgar, against which company suit was brought, the Supreme Court of Iowa made a statement regarding engineering responsibility when such disputes arise. Generally, the court said, the acceptance and approval of a structure by an engineer appointed by agreement of the parties to inspect and pass upon the work is conclusive and binding on the parties in the absence of fraud or such gross mistake as would necessarily imply bad faith or a failure to exercise an honest judgment. Where, however, the contract for the construction of a dam and power plant specified that the approval and acceptance of the structure by the designing engineer should be binding on both parties, but both the engineer and the contractor were guilty of gross mistake in the use of materials and in workmanship, the owner was not bound by the engineer's acceptance and approval of the building. (195 N. W. 754.)

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Experience Creating "Cash Discounters"*

Interesting Details of a Plan Which Has Been Applied by Electrical Manufacturers and Jobbers in Milwaukee

By S. C. Greusel
G-Q Electric Company, Milwaukee

IT IS almost impossible to secure from the average contractor-dealer a financial statement conveying in an intelligent manner the status of his business. This is due largely to his having no understandable or workable accounting system, the lack of which retards his progress and in many cases results in financial disaster. It is needless to say that every wreck of this kind costs the credit grantor real money.

Realizing that such a condition existed, certain jobbers and manufacturers in Milwaukee some time ago concluded that it was good business, in addition to the almost universal custom of setting up a reserve account against losses on accounts receivable, to spend a reasonable amount in real constructive credit work, the result of which it was hoped would be beneficial to both their patrons and themselves.

How Plan Works

The working of the plan has been something like this: A customer of this class whose account bears evidence of need of assistance is interviewed by the credit manager of the jobber or manufacturer with the view of ascertaining the cause of his delinquency. If the result of this interview indicates the need of business counsel and advice, it is freely given, but in most cases it is found that the condition of the contractor is due to the fact that he is lacking in the proper knowledge of his costs. In a case of this kind the installation of the system which has been developed by the Association of Electragists is recommended.

If the delinquent refuses to adopt this system or to otherwise systematize his affairs and continues in his failure to pay his invoices when due or within a reasonable time thereafter, it becomes a difficult matter for him to secure further credit accommodations. Incidentally, it might also be stated here that a number of contractor-dealers in Milwaukee have adopted this system of accounting and have increased their profits and efficiency thereby.

Fund Subscribed

We appreciated that the recommendation of a system, however good, would avail very little unless it was properly installed and kept up, and as it is generally conceded that a man is a contractor primarily for the reason of his knowledge of matters electrical and that his knowledge concerning accounting, the value of turnover, of cash discounts and other related subjects is usually very limited, a fund was subscribed by the jobbers, manufacturers and local contractor-dealers' association sufficient to carry on this work.

From this fund, when it is necessary, money is drawn for the furtherance of the program, it being contemplated that upon proper installation of the system the contractor-dealer will assume the expense incurred and reimburse the fund for the amount advanced in his interest. After the installation has been made records may be kept up by this accountant for a nominal amount. For instance, to a contractor whose volume of business does not exceed $2,500 per month a charge of $5 per week is now being made, on the volume of $5,000 a month a charge of $7.50 per week, and so on.

This fund is drawn upon and the accountant is paid from it to install this system, with the thought that when the contractor or the dealer has been "sold" on the system, when it is working and he has a fair demonstration of what it is doing for him, the fund will be reimbursed. I am very gratified to state that our original fund is again intact.

The plan in this way is self-supporting, and with a sufficient number of accounts the accountant receives a reasonable income for his services and each contractor has his affairs properly accounted for at a minimum of expense. The jobber selling such accounts has the advantage of obtaining intelligent reports as to the status of the business.

A number of contractors have improved their financial condition since the adoption of the system and have removed themselves from the delinquent list and today are taking advantage of cash discounts and increasing their profits accordingly. They have been taught their cost, which they thought they knew, but didn't. They no longer allow their customers to name their prices, but accurately determine their material and labor costs so as to show a profit rather than a loss.

"Business Pulmotor"

Another plan that is employed in Milwaukee where circumstances and conditions warrant is what might be termed "the business pulmotor." This machine differs from the kind that administers oxygen to the seemingly lifeless form and consists usually of three individuals representing interested creditors acting in the capacity of a creditors' committee receivership, who work with the contractor-dealer whose business for various reasons has failed to prosper.

One instance of the kind of constructive work which the creditors' committee is doing is the case of a dealer who had prepared a voluntary petition in bankruptcy but was prevailed upon to defer the filing of it. A meeting of the creditors was arranged for, and after carefully considering all aspects of his affairs a creditors' committee was appointed, and instead of the creditors receiving about 25 cents to 30 cents on

*Extracts from a recent talk given before the Central Division, National Electrical Credit Association, Chicago, Nov. 20-21, 1923.

the dollar, which no doubt was all they would have received had the bankruptcy petition been filed. They have already received 85 per cent of their claims and I am confident that by April 1 next they will receive the remaining 15 per cent and the name of the dealer be kept from the bankruptcy records. The creditors' claims in this case exceeded $25,000.

An Opinion on the Vehicle Outlook

Central-Station Support for the Electric Truck Grows Steadily—"Electrics" Must Now Be Reckoned with in Any Study of Transportation Problem

BY E. R. WHITNEY
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AS I SEE it, there has been one particularly conspicuous advance made in the electric vehicle industry during the year 1923, and this is one of the most promising factors in the outlook for 1924. I refer to the greatly increased recognition of the electric truck by the larger central-station companies of the country—an awakening that is the direct result of the excellent promotion work done by the Electric Transportation Bureau of the National Electric Light Association and the Society for Electrical Development. The co-operation of these bodies with the electric vehicle and battery manufacturers has accomplished results that are most encouraging, not only in arousing the interest of central stations, but in bringing about a more widespread enthusiasm throughout the entire industry than has ever before existed.

CENTRAL-STATION SUPPORT

There is no question that the coming year will see central stations in many localities working to promote the electric vehicle both because of the tremendous load possibilities in the charging of electric truck batteries and because of the recognition of electric vehicles as an economical and reliable means of city transportation and as one of the most promising factors in relieving the troublesome traffic congestion in our cities. I might mention as just one notable example of the way central stations are coming to recognize the importance of this the case of the Pacific Gas & Electric Company, which has during the year established an electric truck bureau and has already done much active work toward promoting the development of the electric truck market on the Coast, and with excellent results.

As for the outlook for the electric truck market in general during 1924, the trend is decidedly upward and, with reasonably good business conditions, the year should be the best yet experienced by the industry. Many new electric truck users have been added to the already long list during the past year, and many more concerns with city delivery and hauling problems will begin using "electrics" for the first time in 1924. The market has continued to increase in New York and Chicago, and in the latter city particularly I believe the trend is toward a development hardly less great than in New York. In Philadelphia the market has remained steady without a very material increase during 1923. With increased facilities for selling and servicing electric vehicles, however, the coming year should see a steadily developing market at that point. On the Coast there is a very decidedly increased activity which will continue through 1924.

Another very significant indication that the electric truck is now more than ever before considered as having an important place in the general problem of transportation, is the fact that it receives serious consideration when a question as to how best to handle a particular transportation problem is being considered by large users of trucking and delivery equipments of all kinds. A very interesting example of the recognition of the electric truck is contained in a recent general circular sent out by the Department of Commerce from Washington, the purpose of which was to point out the importance of making early shipments during the holiday rush; in explaining the reasons why sufficient time must be allowed a full description of how shipments are handled was contained in the circular, which included:

"The express pick-up man calls, gives you a receipt for your package and moves it to one of the electric trucks which are used for this short multi-stop pick-up work. Then it is stowed with 100 or more other shipments of all kinds.

"If the consignee lives in a congested part of the city, a dependable electric truck will form the final link. If the consignee lives in the suburbs, a fast-moving gasoline truck will be used."

The situation generally in the electric truck industry to-day is most encouraging and shows clearly what can be accomplished by proper organization and co-operation from the various electrical interests.

Standardizing Fittings in Apparatus Development

USERS of carefully designed electrical apparatus who specify departures from standard designs seldom have much idea of the complication this course often throws upon the manufacturer. Progress would stop if only standard products were purchased, but in manufacturing circles it is widely held that specific and well-considered reasons should be forthcoming in order to warrant the development of apparatus of special character. An example of the cost of even a slight modification in the design of a portable load box is of interest in this connection.

In the developmental period of this apparatus it was found that by the use of an aluminum frame and resistor material woven into asbestos sheets the weight of the box could be reduced to about 3 lb. The selection of a proper plug design then came to the front, and it was found that to develop a plug with recessed terminals so that contact pins could be used on the load box, something like two months of work at a cost of hundreds of dollars for designing and trial fittings would be required. There would be little or no opportunity to produce short circuits in using the device with the recessed plug. At this time the manufacturer was otherwise in a position to turn out 10,000 load boxes in short order. Had production got well under way the cost would have doubtless been far greater.

Census Bureau Urges Quick Returns from Manufacturers

THE Bureau of the Census is now engaged in collecting statistics of electrical manufacturers covering the calendar year 1923. These statistics are compiled in accordance with the act of Congress of March 3, 1919, and the schedules have been prepared after conference with the

associations and others interested in the various companies. The schedules were mailed to the manufacturers on Jan. 2, and the Director of the Census is very anxious to publish the statistics at the earliest feasible date in order that they may be of the greatest possible commercial value.

The manufacturers engaged in the electrical industry are therefore urgently requested to forward their reports to the bureau as soon as they can—preferably before the end of January. The bureau has agreed to tabulate the results for the industry as rapidly as the schedules are received and to publish the totals within a few days after the receipt of the last report.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

ALTHOUGH the first severe snows of the winter have temporarily slowed down outside work in New England, the most notable feature of the electrical market right now is the influence of the continued activity in line construction. As a result of the unusually open weather and the large amount of construction under way, the sale of outside material has not slackened this winter. Manufacturers of certain lines report themselves sold out until April 1, and strong demand is assured for at least the first six months of 1924.

General building construction holds up strongly and is expected to continue heavy. Jobbers are looking for large orders as soon as the inventory period is over, with no anticipation of any prolonged first-of-the-year lull. In short, business is good throughout the electrical industry. Wholesalers and retailers right now are in a better merchandising condition as to stock than for many years. An unusually good turnover in the jobbing industry was experienced in 1923. Stocks are in a well-balanced condition. Manufacturers are reported as giving good service. General credit conditions are very satisfactory.

Active Demand in Boiler Market —Special Design a Burden

SALES of boilers to central stations and industrial plants for generating purposes are considerably larger than they were one year ago, and where once every order for any sizable boiler called for thorough selling ability, there now seems to be a tendency to buy that product which has proved itself in a given field. In tune with this trend, sales bulletins are now changing in their style of phrasing so as to appeal not only to the engineer but to the average layman as well. In short, manufacturers are depending more on satisfactory performances of their boilers and wider publicity in the central-station field than they have ever done before.

Prices during the last six months have not increased. Plates are quoted at $2.50, and labor generally is hired at 50 cents an hour. Works in New England, Pennsylvania, Ohio and New Jersey are operating at normal rates with no shortage of craftsmen. Manufacturers expect little changes in these operating schedules.

During the last year production has been impeded by engineers who have given full rein to their originality to follow their own ideas, with small regard for standard lines. One leading authority says that a number of years ago approximately 80 per cent of his boilers were built according to standard drawings; today it is doubtful if more than 10 per cent are so built. It would greatly diminish his troubles if purchasers could be brought to a realization that something different for the sake of being different takes longer to make and costs more, and that they, not the manufacturers, pay for this increased cost.

A noticeable interest in air heaters of several types has been recorded in the last few months. In some installations both air heaters and steel-tube economizers have been employed.

On account of the meager data on actual air-heater performance and the effect of installation designs, manufacturers are as yet unable to predict such performance with the same degree of accuracy as in the case of a water economizer, but tests are being made in several plants which should give the necessary information. At present manufacturers are adopting a very conservative policy in the design of air-heater apparatus until satisfactory data shall have been developed.

Keen Competition in the Armored-Cable Market

MORE competitive conditions are reported in the armored-cable market. Manufacturers of quality material, who have recently shown that a price of $41.98 for No. 14 solid to the jobbers does not allow even a fair profit, are most affected by this situation. On the other hand, those manufacturers who are making cheaper grades are known to be operating with prosperous returns.

Jobbers of the better-made material, on the other hand, are finding it most difficult to compete with those who are underselling them at prices that in some instances are only from $1.50 to $2 above their cost prices. It is generally agreed throughout the trade in the East and Middle West that with the increasing costs of delivery, salaries and other overhead charges in the jobbing houses it is impracticable for these wholesalers to sell at less than $46 per 1,000 ft.

Numerous influences seem to be responsible for these highly competitive conditions. The most important factor is the group of manufacturers who have been unloading a great quantity of inferior goods on the market, where there are many contractors who are more interested in low price than in high grade. During the last three months, moreover, numerous firms have been compelled to sell at very low prices in order to pay part of their financial obligations.

Brisk Selling in Illumination Field on Coast—Prices Stable

THE new year has begun very briskly for the electrical business in the Far West. Both building construction and general retail trade are very good. The yearly summaries of building permits show good increases, and this all reacts strongly on the sale of electrical materials and accessories. Dealers report an excellent radio business and an awakening market for radiators. Export selling has been somewhat depressed by the recent eruption of internal troubles in Mexico, but on the whole is better.

There is a marked activity in the field of illumination, with a great deal of ingenuity displayed in the search for and development of new markets for lamps and reflectors. Traffic and billboard floodlighting, for instance, have been receiving particular attention. Prices in all lines are quite stable.

Use of Small Electric Signs by Large Organizations

DEMAND for electric signs of the better class has been very strong throughout the year just ending. A prominent manufacturer reports that sales of double-faced electric signs with raised white-glass letters have been approximately 50 per cent better for 1923 than for any previous year. Much of this increased business comes in the form of large contracts resulting from the use of such signs by manufacturing companies which maintain sales offices in the important cities of the United States. One large automobile company, for example, bought 1,500 signs during the twelve months just ended. Other large orders came from an oil-refining company, several public utility companies and chain restaurants and candy stores.

More contracts with national advertisers were reported during the year than ever before, indicating that this particular form of electric sign is gaining rapidly in favor as part of the regular advertising program of manufacturers who distribute their products

through local sales offices. It is predicted that 1924 will prove even better than 1923. This, it is believed, is largely the result of effort by the sign manufacturers in educating prospective users to the value of this kind of advertising.

Stocks Low and Good Business Outlook in Southeast

OWING to inventories, jobbers in the Southeast report business very dull, no orders being received except for immediate delivery. There was virtually no carry-over of Christmas specialties, and as general stocks are low, substantial orders will be placed within the next few weeks. The only price change reported is a 5 per cent reduction on armored conductor announced by one jobber. Early January witnessed the first cold spell of this winter, and as a result of the mild weather up to that time sales of air heaters have been very good. The wiring of old houses in several cities is being followed up closely, and the number of contracts is increasing steadily.

All jobbers state that their 1923 business showed a substantial increase over 1922, and estimates are that the 1924 volume will exceed this past year by from 15 to 40 per cent.

Construction Active in St. Louis with Good Appliance Markets

THERE is continued activity in new electrical construction work in St. Louis. There has been a splendid demand for lighting fixtures, shades, general household appliances and radio equipment, all of which show an increase over last year. The demand for pole-line hardware has fallen off to some extent, but the sales of automotive equipment are holding up well. The high cost of cotton yarns has advanced the price of non-metallic flexible conduit and all insulated wires and cables. In general stocks are normal, with a fair demand and steady prices.

Collections as a whole are about normal for this period of the year. Current bills are being paid quite promptly, although payments for goods purchased some months ago are not so good as for the corresponding period last year. There has been an active demand for commercial paper. Rates have been a shade easier, ranging from 4½ to 5½ per cent.

Line Material Purchases Vigorous in New England

ACTIVE purchases of poles, crossarms and pole-line hardware were conspicuous in the opening week of the new year in New England, with ample supplies and little overstocking reported among jobbers. Business is running on an even keel in the electrical trade, with steady prices in the main. Wire is a trifle weak and so are glass insulators. Deliveries to jobbers are well maintained from West and South, but heavy snow in northern New England at the week end has slowed up travel and curtailed opportunity for construction work carried exceptionally late into the winter. Collections are fair in Connecticut, with a good outlook for the year. Money in general is easy, and the textile mills are recovering in some places from recent slowdowns or stoppages. Central-station development continues on a large scale. Purchases of electrical supplies for 1924 building programs have not yet been much in evidence. Electrical merchandise sales made a good start at the turn of the year, and one of the largest companies has set a quota of 50,000 kw. for connected new appliance load for the year and 150,000 kw. for power.

Heavy Electrical Work in New York—Fan Selling Begins

FIRM prices and a fair demand are reported for the general line of wiring supplies in the New York market. The only price movement recorded during the past week has been that for armored-cable conductors, which are selling at $22 per 1,000 ft. to jobbers and $23 to consumers. Although the accepted price for No. 14 two-conductor armored cable was $45 in most of the wholesale houses, a decided strengthening to $46 was noted on Wednesday.

Sales in general during the next two months are expected to be substantially above the corresponding period of last year because of the great volume of construction work being carried on in the office building and industrial fields. During the week one of the largest contractors in this district announced that he has on his books at least $6,000,000 worth of electrical work. Among the week's important orders is one for three carloads of black and white conduit for installation in an apartment house being erected in Manhattan.

There is a noticeable increase in heater sales following colder weather. Owing to continued open weather during the last four months, this line of business has not been profitable to any of the jobbers in the Eastern territory. Several jobbers announce that they will commence taking orders for household fans in the coming week for delivery in March. One jobber has already received three carloads from a large manufacturer in the East. He sells on the average twenty-seven carloads each year. Present selling to the dealers is on a ninety-day payment basis.

Tape Advances in Chicago—Radio Strong in the Market

MOST Chicago jobbers resumed active buying the first of the year. Some, however, had not completed their inventory, and consequently their purchases have still been limited. No important price changes were announced other than the expected increase in the price of all tapes. Friction tape advanced about 10 per cent. It is stated that tape manufacturers received an unusual amount of orders the last week in December, indicating that the trade availed itself of the opportunity to get under before the increase in price. Hose prices also advanced approximately 10 per cent the first of the year, with the exception of one manufacturer who did not increase his prices.

Appliance stocks are normal for this time of the year, and the outlook is very promising for 1924. Radio sales, of course, have been exceptionally good. Jobbers report that the Christmas buying was the best at any time since this boom began, back in 1922. The public called for complete outfits, and the demand was equally good for both regenerative and reflex sets..

The number of installations of radio sets this Christmas made an inroad in porcelain stocks due to installation requirements. However, stocks with manufacturers are ample and rapid shipments can be made. Porcelain knobs and tubes for temporary construction work are not in great demand owing to the recent cold weather.

The Metal Market

ELECTROLYTIC copper at the beginning of the week sold at 12.87½ cents, delivered, which was recognized throughout the trade as the official price. Domestic inquiry is very spasmodic and only for moderate quantities, while export demand is practically nonexistent. Smelter production of copper during 1923, including an estimate of 132,000,000 lb. for December, amounted to 1,477,000,000 lb., an increase of approximately 55 per cent over 1922, according to figures compiled by the Geological Survey. The total output of refined copper from domestic sources was placed at 2,248,000,000 lb., a gain of 743,000,000 lb. With stocks of copper in this country at the close of 1923 estimated at 256,000,000 lb., comparing with 216,000,000 lb. at the beginning of last year, opinion in the trade is that there will be no increase in production in this country for some time unless there is a sudden renewal of demand from abroad.

NEW YORK METAL MARKET PRICES

	Jan. 3, 1924 Cents per Pound	Jan. 10, 1924 Cents per Pound
Copper, electrolytic	12.87½	12.87½
Lead, Am.S.& R.price	7.50	7.75
Antimony	10.00	10.00
Nickel, ingot	27.00 to 30.00	26.00 to 30.00
Zinc, spot	6.35	6.30
Tin, Straits	47.12½	47.00
Aluminum, 98 to 99 per cent	27.00	27.00

Lead is the strongest seller among the metals at a price of 7.75 cents, New York, but prices in the outside market range from 8 cents to 8.25 cents. There is little business reported in the zinc market, and although producers are holding to 6.35 cents, the real market is more nearly 6.30 cents for prompt and 2½ cents for futures.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Bath Iron Works May Be Taken Over by General Electric

Negotiations are reported to be under way between the General Electric Company and the Bath (Me.) Iron Works by which the former is considering the purchase of the latter for use as a tidewater manufacturing plant. It was announced at Portland Monday that Nelson J. Darling, manager of the River works of the General Electric Company, Lynn, Mass., would confer on Tuesday at Bath with former Governor W. T. Cobb of Maine and M. S. Bird of the Bath plant in regard to the possibilities of taking it over. It has been known for some time that the General Electric Company has been looking toward the acquisition of another tidewater factory.

Habirshaw Bondholders Win Move to Withdraw Securities

An order signed last week by Federal Judge Knox in New York City permits the bondholders and other creditors of the Habirshaw Electric Cable Company and its subsidiaries to withdraw their bonds, notes and other securities from the reorganization committees, which are enjoined from making any use of the securities or from taking any action incurring liabilities on the part of the bondholders.

Pittsburgh Transformer Order

The Long Bell Lumber Company, Seattle, has recently awarded to the Pittsburgh Transformer Company, Pittsburgh, through its Seattle representatives, Eicher & Bratt, a contract for transformers totaling 22,600 kva. in capacity and to cost $80,000. The transformers will be used in stepping up the voltage at the Long Bell power plant and logging camps and for use in supplying light to the town of Longview, Wash.

Allis-Chalmers Unfilled Orders at Rate of $12,043,000

The unfilled orders of the Allis-Chalmers Manufacturing Company on Dec. 1, according to reports from that company, were $12,043,000, as compared with $12,200,000 on Nov. 1 and the high record for the year of $13,140,000 on July 1. With the recent $600,000 order from the Public Service Company of Northern Illinois, it is expected that a gain in orders will be shown in the January report.

The company had at work 6,569 employees on December 1, as compared with 6,742 the previous month and 6,904 at the high point of the year, September 1. Shipments, according to officials, are expected to continue near maximum. The outlook for 1924 is bright, with business for the first half of the year well up to the rate of the last six months.

General Refractories Orders Show Decided Progress

The General Refractories Company's business has shown decided progress within the past few weeks, according to reports from that firm's officials. Much business comes from lines extended in many directions, notably in boiler and power-plant work and in copper, zinc and other refining processes.

An interesting development has been in the perfection of the sizing machine for making brick of uniform size, according to an official. It will enable the company to obtain better prices. Base prices for the first quarter of 1924, as regulated by contract acceptances from the principal interests in the trade, are being made at the same rate as has prevailed during the past quarter. The company expects a stiffening of prices within the next three months if there should be any change at all.

Anaconda Copper Reports on Operating Costs

The Anaconda Copper Mining Company during the fiscal year ended May 31, 1923, extracted 2,382,064 tons of ore from its mines in the Butte district, according to its report to the State Board of Equalization for the purpose of fixing taxation on the net proceeds. Of this total 2,280,661 tons were taken from the Butte hill, while 59,006 tons came from the Emma and 42,397 tons from the Nettie mine. In addition to ore extracted, the company during the same period worked 1,289,040 tons of reduction works tailings.

The gross value of the ores treated or sold in this period is given as $32,100,286, and the cost of mining the ore amounted to $16,712,179. This figure was reduced by the Board of Equalization to $16,703,621.

Black & Decker Announce New Prices on Electric Tools

The Black & Decker Manufacturing Company, Baltimore, has announced new prices for its portable electric tools. On December 29 it reduced the prices on ¼-in., ⅝-in., 15/16-in., ½-in. and ¾-in. heavy-duty portable electric drills approximately 12 per cent, and also the prices on 4-in., 5-in. and 6-in. portable electric grinders by the same amount. This was the second reduction in 1923 of prices of the heavy-duty tools made by this company, quite a substantial reduction having been made on June 1. On Nov. 12 the company's ½-in. special drill was reduced from $68 to $58.

Kennecott and American Leave Copper Export Association

Following a meeting last week, the Copper Export Association announced that the Kennecott interests, the American Smelting & Refining Company and the Phelps-Dodge Corporation had withdrawn from membership, effective Feb. 1. No reason for the withdrawals was contained in the statement issued by R. L. Agassiz, president of the association and president of the Calumet & Hecla Mining Company, who, it is understood, will continue as the association's head.

The announcement was interpreted by interests in the copper industry as a denial of reports that the association would disband. The withdrawals leave the association with about 55 per cent of its old membership and necessitate a readjustment of its directorate.

Sanford Riley to Manufacture Pulverized-Coal Equipment in Own Name

The Sanford Riley Stoker Company, Worcester, Mass., announces that it no longer has any interest, financial or otherwise, in the Ground Coal Engineering Corporation or its successor, Universal Engineers, Inc. The Sanford Riley company will continue in the pulverized-coal business on its own account and will announce from time to time the apparatus which it will manufacture and sell.

Standard Fibre Organizes Electrical Department

The Standard Fibre Company, Inc., Miller Street, Somerville, Mass., has organized a division for the manufacture and sale of electrical insulating material under the name of the Standard Fibre Products Company to operate at the above address.

Western Electric Appoints Kearny Works Personnel

H. G. Dean, inspector of plants, Western Electric Company, with headquarters at New York, has been appointed plant manager at the works of the company now in course of construction at Kearny, N. J. Other appointments just made for this plant are: F. A. Macnutt, clerical and production superintendent, heretofore supervisor of the personnel and installation department at the Hawthorne (Ill.) works; G. A. Landry, assistant technical superintendent, manufacturing department previously engineer in the installation department, Hawthorne plant; Frederick Kuster, assistant clerical superintendent, manufacturing department

heretofore superintendent of equipment service, Hawthorne, and E. G. Johnston, assistant superintendent of industrial relations, for several years past at the Hawthorne plant as assistant superintendent of industrial relations in charge of research work.

Another Jobbing House in Denver

The Elliott-Schmidt Electric Supply Company has been organized by two well-known electrical men of Denver as a jobbing house. The principals are Roy W. Elliott, who resigned his position as sales manager and purchasing agent of the Albert Sechrist Manufacturing Company after eighteen years of service, and K. B. Schmidt, a prominent local manufacturers' agent.

Although regular supplies will be handled, it is understood that the new firm will concentrate on the distribution of those specialties previously featured by Schmidt. Among the accounts announced are those of the Mutual Lamp Manufacturing Company, Sunset Lighting Fixture Company, Hamilton-Ross Shade Company, M. Propp & Company, Northern Electric Company, Frank E. Walcott Manufacturing Company, the United Metal Spinning Company, Standard Metal Spinning Company and the Incandescent Supply Company. A location has been obtained at 217 Fifteenth Street, in the center of a number of contractor-dealer establishments.

Wetmore-Savage Sales Conference Bespeaks Favorable Outlook

Healthy growth of wholesale trade within the electrical and allied automotive industries was forecast at the annual sales conference of the Wetmore-Savage Company, Boston, electrical supply jobber, held Dec. 27 and 28 at the Exchange Club, Boston. Karl L. Norris, head of the company's appliance division, presided. The program included addresses on business conditions and sales problems by L. L. Brastow, Trumbull Electric Manufacturing Company, Plainville, Conn.; A. G. Kimball, J. S. Kennedy and G. Q. Porter, Landers, Frary & Clark, New Britain, Conn.; A. W. Marcou and C. C. Walker, Bryan Marsh Electric Company, Boston; Messrs. Patrick and Kodjbanoff, Benjamin Electric Company, New York; Bradley and Tuohey, Holophane Company; Hibbard, National Carbon Company; D. Caywood, Black & Decker; Chapman and Reed, Bryant Electric Company; Lawrence Page, Boston, and S. J. King, J. W. Johnson. J. G. Waddell and Frank Burtt of the Wetmore-Savage staff.

The Independent Electrical Supply Company, Inc., 59 Warren Street, New York City, announces that after Jan. 2, 1924, its salesrooms and offices will be at 52 Murray Street, where it recently purchased two buildings, and when alterations are completed the company will be in a position to handle a much larger volume of business at a reduced percentage of overhead expense. The company will continue to operate its branch at 59 Warren Street until that building is sold, and the warehouse at 55 Warren Street will be abandoned May 1, 1924.

The Park Battery Company, 277 East 156th Street, Cleveland, has awarded a contract for a two-story factory, 79 ft. x 152 ft. The estimated cost is $75,000.

The United Battery Corporation, Carthage, N. Y. (John J. Wetmore, Northwestern Title Company Building, president), has plans nearing completion for the erection of a local plant at Washington and Cemetery Streets for the manufacture of storage batteries and kindred equipment. It will be one-story, 150 ft. x 250 ft., estimated to cost in excess of $80,000, with machinery. Gustave Koehler, Poughkeepsie, N. Y., is engineer.

The Crescent Electric Supply Company, Dubuque, Iowa, has opened a branch store in Madison, Wis. W. R. Muehl, formerly with the Taylor Electric Company, Madison, the supply stock of which has been taken over by the Crescent company, is in charge as manager.

The Locke Insulator Company, Baltimore, has filed plans for the erection of a new building at Charles and Cromwell Streets, to cost about $22,000, and will break ground at once.

The Federal Electric & Radio Corporation, Park Building, Pittsburgh, is perfecting plans for the erection of a new one-story plant on a local site. J. E. Mair is one of the heads of the company.

New Equipment Available

Short Descriptions of New Apparatus and Accessory Equipment of Interest to the Electrical Industry and Available from Manufacturers and Announcements of New Lines

Single-Phase Voltage Regulator

The General Electric Company, Schenectady, N. Y., has developed an induction regulator of new design. The inclosing tank is of all-welded steel constructed of heavy boilerplate with flattened steel boiler tubes for radiation. The motor is assembled at the back with its brake on the left and the handwheel control on the right side. Relay and limit switches are in front. A tank highly resistant to rupture, increased rigidity of structure to reduce noise, improved coil bracing, greater accessibility of operating mechanism and better voltage regulation are desirable features claimed.

Heavy-Duty Portable Elevator

An industrial storage-battery truck that will take a load at any height up to 6 ft. and deposit it on the floor or at any level up to 6 ft. has been placed on the market by the Elwell-Parker Electric Company, Cleveland, Ohio. Its capacity is 6,000 lb., and the dimensions are 9 ft. 4 in. long by 7 ft. 11 in. high. The truck has been designed to pass through a 3-ft. 6-in. doorway. The battery compartment holds thirty Edison cells or sixteen lead cells. The truck weighs with battery 5,200 lb. and travels from 300 ft. to 400 ft. per minute, and the load platform may be raised or lowered from 5 ft. to 6 ft. per minute.

Mercury-Vapor Unit. — Several improvements have been made by the Cooper-Hewitt Electric Company, 95 River Street, Hoboken, N. J., on a new model mercury-vapor lighting unit, recently announced. The series-resistance units are mounted in screw sockets to be easily replaceable. The transformer and inductance coils are protected by winding with a wire insulated with both enamel and cotton, impregnated with insulating varnish and baked. Transformer taps for various voltages are provided. A similarly improved direct-current unit has also been announced.

Meter for Measuring Current, Voltage and Resistance.—A combined ammeter, voltmeter and ohmmeter has been patented and placed on the English market by the Automatic Coil Winding & Electrical Equipment Company, Ltd., of London. The instrument is of the moving-coil type. It covers the following ranges: Amperes, 0 to 0.12, 0 to 1.2 and 0 to 12; volts, 0 to 12, 0 to 120 and 0 to 600 (or up to 1,200 volts if required); ohms, 0 to 5,000.

Battery Charger.—The Electric Products Company, 1725 Clarkson Road, Cleveland, has developed a vertical constant-potential battery charger in which the generators are driven by separate motors. Thus, in three-wire systems batteries can be "formed" on one side of the system while charging on the other side. The equipment is built in both the two-wire and three-wire types, and when a two-wire machine is installed a second unit can be added to make a three-wire system.

Pressure Switches.—A line of pressure switches for steam and vapor systems which are provided with mercury-tube switches has been brought out by the Absolute Contactor Corporation, Beloit, Wis.

Fusible Primary Cut-Out.—The General Electric Company, Schenectady, N. Y., has developed a new type of cut-out for fusing the primary circuit of transformers up to 7,500 volts, 100 amp. maximum. The protective equipment is inclosed in a wooden box, and adjustable galvanized malleable-iron hangers are provided.

New Trade Literature

STOKERS.—"Burning Waste Fuels", is the title of a new bulletin issued by the Sanford Riley Stoker Company, Worcester, Mass., which gives information of interest to engineers on the adaptability of its various stokers for burning waste fuel.

ENGINEERING DATA.—The Copper Clad Steel Company, Braddock (P. O. Rankin), Pa., has brought out a loose-leaf binder for use in connection with its leaflets on engineering data, purchasing, inspecting and testing, sag and tension charts and tables on the subject of "Copperweld" published from time to time by the company.

RAILWAY MOTORS AND ELECTRIC LOCOMOTIVES.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued three leaflets dealing with railway motors and electric locomotives. Leaflet No. 20,124 gives specifications for class B-1, 50-ton locomotive, including ratings of hourly continuous and maximum capacity. Leaflet No. 20,125 contains specifications for the No. 562 railway motor, and leaflet No. 20,947 specifications and information relative to railway motor No. 557.

PLATING AND ELECTRO-GALVANIZING APPARATUS.—The U. S. Galvanizing & Plating Equipment Corporation, 32 Stockton Street, Brooklyn, N. Y., is distributing a folder describing the "U. S." moving cathode apparatus for plating electro-galvanizing.

COAL PULVERIZER.—The American Pulverizer Company, St. Louis, is distributing a report written by H. M. Killmar, mining engineer, concerning the production, cost and operating analysis of an "American Ring" coal crusher used by the Mount Olive & Staunton Coal Company, St. Louis.

SPEED REGULATORS.—Bulletin No. 57 issued by the Ward Leonard Electric Company, Mount Vernon, N. Y., covers its "Vitrohm" speed regulator.

TRANSFORMERS.—Bulletin No. 1,223 issued by the Esterline-Angus Company, Indianapolis, describes and illustrates its "Universal" current transformers and also describes its electrically operated chart drives used on Esterline-Angus instruments.

POLE-LINE INSULATORS.—The Illinois Electric Porcelain Company, Macomb, Ill., is distributing a pamphlet entitled "Handbook of Pole-Line Insulators" covering the various types of the "Illinois" high-tension insulators.

Foreign Trade Opportunities

POWER PLANT FOR MINING COMPANY IN BRAZIL.—The construction of an electric power plant of 20,000 kw. capacity near its coal mines, *Commerce Reports* states, is under consideration by the Cia Estrades de Ferro e Minas S. Jeronymo of the State of Rio Grande do Sul.

AUTOMATIC TELEPHONE SYSTEM PROPOSED FOR BELFAST, IRELAND.—A plan has been approved by the British Post Office Department for the installation of an automatic telephone system in Belfast, according to *Commerce Reports*. This work, it is said, will require from three to four years to complete. At present there are about 8,000 telephones in the city and suburbs of Belfast. American manufacturers interested should correspond direct with the Post Office Department at London, as the local post officials have no authority to discuss this development.

HYDRO-ELECTRIC DEVELOPMENT PROPOSED IN GALICIA, SPAIN.—The Sociedad General Gallega, *Commerce Reports* states, is negotiating for the purchase of the properties of the Electra Popular Vigo y Redodela and the Gas y Electricidad de Santiago to be merged into one company, capitalized at 20,000,000 pesetas, which will be capable of furnishing electricity throughout Galicia. This company is now planning to build an additional plant on the Tambre River, near Noya, at a cost of about 20,000,000 pesetas.

ELECTRIC RAILWAY CONCESSION GRANTED IN POLAND.—The Polish government has granted a concession for the construction of an electric railway to extend from Cracow to Kattowitz. The proposed road must be in operation by 1930.

CONCESSION GRANTED IN SPAIN FOR POWER DEVELOPMENT.—A concession has been granted by the Spanish government to utilize the water power of the River Rudron, near Valdelateja, Province of Burgos, to generate electricity for lighting and power purposes.

TENDERS FOR ELECTRIC PLANT, WELLINGTON, NEW ZEALAND.—The date for receiving tenders by the Board of Public Works, Wellington, for the power house and plant, section 2, of the Arapuni electric power scheme has been extended from April 30 to May 24.

PROPOSED ELECTRICAL CONSTRUCTION IN TASMANIA.—Provision has been made for the erection of a transmission line and substation to Zeehan on the west coast by the Public Works Department of Tasmania in connection with the hydro-electric plant at Lake Margaret.

CONCESSION GRANTED FOR THE DISTRIBUTION OF ELECTRICITY IN FRANCE.—A concession for the distribution of electricity in a number of districts in the department of Indre-et-Loire and Vienne has been granted to the Compagnie Générale du Gaz pour France-et-l'Etranger.

New Incorporations

THE UNITED LIGHT & POWER COMPANY, 101 East Fayette Street, Baltimore, Md., has been incorporated by Douglas H. Rose, George S. Newcomer and Leslie E. Mihm.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

LONG FALLS, ME.—Governor Baxter of Maine has opened negotiations with utility interests for the construction of a hydro-electric plant on state property on the Dead River, near Long Falls.

DORCHESTER, MASS.—The Edison Electric Illuminating Company plans to build a substation on Hoyt Street.

TAUNTON, MASS.—Contract has been awarded by the municipal electric light commissioners for the construction of a substation for the municipal electric plant.

JEWETT CITY, CONN.—The Eastern Connecticut Light & Power Company is planning improvements to its local plant, including a substation, to cost about $30,000.

OAKVILLE, CONN.—The Autoyre Company, manufacturer of wire products, etc., plans to install electric power equipment in its proposed addition, to cost about $100,000. The Fletcher-Thmpson Company, Bridgeport, is architect and engineer.

Middle Atlantic States

BALLSTON SPA, N. Y.—The Board of County Supervisors is considering building a power plant at the Homestead Sanitarium of the County Tuberculosis Hospital, to cost about $50,000.

COHOES, N. Y.—Arrangements have been completed by the Cohoes Power & Light Company for the installation of an additional 14,000-hp. generating unit at its power house on School Street during the coming year.

HERKIMER, N. Y.—The installation of an ornamental lighting system is under consideration by the Municipal Commission.

NEW YORK, N. Y.—The New York Edison Company has purchased the power house property of the New York Railways Company on First Avenue. The plant will eventually be remodeled and used as a power plant by the former company.

NEW YORK, N. Y.—Bids will be received by Edward W. Buckley, commissioner of purchases, Room 526, Municipal Building, until Jan. 15 for furnishing electrical materials and supplies, and telegraph and fire alarm parts to Bellevue and Allied Hospitals, and Department of Plant and Structures, Street Cleaning, Water Supply, Gas and Electricity, Police and Fire Departments, for a period ending March 31, 1924.

NEW YORK, N. Y.—Bids will be received by William H. Gompert, architect, board of education, Flatbush Extension and Concord Street, Brooklyn, until Jan. 16 for installing gas and electric fixtures in annex to Public School 72, borough of Manhattan; Public Schools 63, 70 and 75 borough of the Bronx; Public School 42, borough of Queens; Public School 177, borough of Brooklyn. Also for additions and alterations to electric equipment and fire signal systems in Public Schools 5, 7, 8, 11, 12, 14, 30 and 108, borough of Brooklyn.

ONONDAGA, N. Y.—The Onondaga Utilities Corporation, recently incorporated, has petitioned the Public Service Commission for permission to supply electricity in Tully and Central Square and in the towns of Tully, Fabius, Lafayette, Salina, Clay, Cicero and Hastings, and also for authority to issue $120,000 in capital stock for the acquisition of the existing electric companies operating in those municipalities, etc.

POUGHKEEPSIE, N. Y.—The Ford Motor Company, it is reported, is considering building a power plant in connection with the development of the Johansson plant recently acquired by the company.

SCHENECTADY, N. Y.—Surveys are being made by the Adirondack Power & Light Company for a generating plant in the Cranesville section, to cost about $300,000, with transmission lines.

ASBURY PARK, N. J.—The Board of Commissioners has requested the Atlantic Coast Electric Light & Power Company to place all its wires on Main Street in underground conduits. The cost is estimated at about $75,000.

MATAWAN, N. J.—The Metallurgical & Chemical Company contemplates the installation of electric power equiment at the former plant of the American Tin Smelteries, Inc., recently purchased by the company.

MONTCLAIR, N. J.—Steps have been taken by the Montclair Chamber of Commerce for improvements to the lighting system on Bloomfield Avenue.

NEWARK, N. J.—The Wilmington Sugar Refining Company, Wilmington, Del., is negotiating with the city officials for a lease of property at Port Newark for a site for a proposed refining plant and power house, to cost about $4,000,000. Adolph Segal, Pennsylvania Building, Philadelphia, is head of the company.

ALTOONA, PA.—The Pennsylvania Railroad Company has contracted with the Penn Central Light & Power Company to furnish 2,000 kw. for its local operating department.

BETHLEHEM, PA.—Plans are being considered by the Chambers of Commerce of Bethlehem and Easton for lighting the William Penn Highway between the two cities.

COATESVILLE, PA.—Work will be started at once by the Chester Valley Electric Company on extensions to its transmission lines covering 11¼ miles. A line will be erected from the substation at Newlinville to the plant of the General Paper Company at Beaver Dam (4 miles), where a substation will be erected. The line will eventually be extended into Buck Run. Another line will be extended from Downington to Glen More, a distance of 7 miles. Substations for this line will be built at Glen More and at Lyndell.

FRANKLIN, PA.—The South Side Business Men's Association has presented a petition to the City Council asking for the installation of an ornamental lighting system in the South Side business district.

GREENVILLE, PA.—The Penn Central Light & Power Company, Altoona, is planning to erect a transmission line in Greenfield Township.

MUNCY, PA.—The Muncy Township-Lycoming Electric Company has applied for permission to install a system to furnish service in Muncy Township. A transmission line will be erected and substation installed.

NEWPORT, PA.—Application has been made to the Federal Power Commission by the Junianta River Power Company, Pottsville, and the Watts Water Power Company, Harrisburg, for permission to build a dam across Junianta River and a power house near Newport.

READING, PA.—Plans are being prepared by the Reading Hardware Company for a power house at its plant, to cost $90,000. The Ballinger Company, Twelfth and Chestnut Streets, Philadelphia, is architect.

TOWANDA, PA.—The Towanda Gas & Electric Company is planning to consolidate the Asylum Township and Standing Stone Electric companies, operating in Bradford County. Extensions will be made in the transmission systems.

HAGERSTOWN, MD.—The city has been denied permission to issue $300,000 in bonds for a new municipal power plant.

HAGERSTOWN, MD. — The Potomac Public Service Company has been merged with the Edison Electric Company, Cumberland, under the name of the Potomac-Edison Company. Authority has been granted to issue $750,000 in bonds, part of the proceeds to be used for extensions, including additional transmission lines and equipment for the Northern Virginia Electric Company, a subsidiary.

CLARKSBURG, W. VA.—The West Penn Power Company, Pittsburgh, has acquired the property of the Clarksburg Gas & Electric Company. The former company is erecting two transmission lines into Clarksburg to connect the local system with the generating stations of the company at Windsor and Rivesville, W. Va., and Connellsville and Springdale, Pa.

WASHINGTON, D. C.—Bids will be received by the Bureaeu of Yards and Docks, Navy Department, until Jan. 30 for motors, pumping machinery, electrical work, etc., at proposed new mooring masts at San Diego, Cal.; Fort Worth, Tex., and Guantanamo, Cuba. (Specification 4916.)

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Jan. 29 for electrical supplies for Eastern and Western yards. (Schedule 1749.)

North Central States

COLUMBUS, OHIO. — The Public Utilities Commission has authorized the Northeastern Ohio Power & Light Company to issue $47,000 in capital stock, the proceeds to be used for the erection of a transmission line from Ashtabula to Conneaut and transmission and distributing lines between New Kingsville and Kingsville.

FORT RECOVERY, OHIO.—Extensions and improvements are contemplated to the municipal electric lighting system, to cost about $2,750.

LEBANON, KY.—The Kentucky Utilities Company, Louisville, is reported to be negotiating for a franchise in Lebanon. If acquired, it is understood ,that it will take over the plant and system of the local company.

LOUISVILLE, KY. — The City Council contemplates further extensions to the ornamental lighting system, to include many of the downtown streets.

LOUISVILLE, KY.—The Interstate Public Service Company, Wild Building, Indianapolis, contemplates erecting a 66,000-volt transmission line from a proposed plant in Indiana across the Ohio River to Louisville, to cost about $25,000.

LOUISVILLE, KY.—Plans for the proposed local assembling plant of the Ford Motor Company, Detroit, on the waterfront, to cost about $750,000, include a power house. Albert Kahn, Marquette Building, Detroit, is architect.

LOUISVILLE, KY.—The Louisville Gas & Electric Company has tentative plans for the erection of a general service and equipment distributing plant at Seventh and Dumesnil Streets, to cost about $200,000.

OWENSBORO, KY. — Plans are under consideration for extensions to the municipal electric plant, to cost about $115,000. W. M. Watson is engineer.

BLOOMINGTON, IND.—Extensions and improvements are contemplated by the Showers Brothers Company, involving an expenditure of $500,000. The plans include the construction of a new power plant, to cost about $250,000.

BLOOMINGTON, IND.—Bids will be received at the office of the Bloomington Water Company until Jan. 29 for improvements to waterworks, including pipe line, dam and a small pumping station containing two electrically driven centrifugal pumps, each of 1,500,000 gal. capacity, operating against an average head of 345 ft. Pearse, Greeley & Hansen, 39 West Adams Street, Chicago, are engineers.

CROWN POINT, IND. — The Calumet Electric Company is negotiating for the purchase of the local system of the Interstate Public Service Company, including systems at Lowell, Cedar Lake and vicinity. Extensions are planned, including the erection of additional transmission lines.

INDIANAPOLIS, IND. — The Northern Indiana Power Company has arranged for an increase in capital of $1,500,000, part of the proceeds to be used for extensions.

LINCOLN, ILL.—The City Council has voted to submit to the voters at the spring election the proposal to issue bonds to establish a municipal electric light plant.

SPRINGFIELD, ILL. — Extensions and improvements involving an expenditure of about $1,200,000 are contemplated by the Illinois Power Company during the coming year. Of this amount $900,000 will be expended in Springfield and the remainder in the further development of the De Kalb-Sycamore properties. The work will include the construction of a large central substation at Eleventh and Jackson Streets, to cost about $200,000.

TOMAHAWK, WIS. — The Wisconsin Valley Electric Company is planning to install a lighting system in the eastern section of the city.

BRAINERD, MINN.—The Northern Pacific Railroad Company, St. Paul, plans to build a power house at its proposed local shops, to cost about $700,000.

BRAINERD, MINN. — The Northern States Power Company contemplates building a hydro-electric plant at Oxbox Rapids, on the Mississippi River, to cost about $900,000. A transmission line will also be erected.

MOORHEAD, MINN.—The City Council is considering improvements to the municipal electric and water plant, to cost about $55,000, or building a new plant at a cost of $125,000.

ST. PAUL, MINN. — Preliminary plans are being prepared for a power plant on the campus of Macalester College, Grand and Snelling Avenue, to cost about $45,000. W. M. Ingemann, Endicott Building, is architect.

DES MOINES, IOWA.—The State Fair Association is having plans prepared for the installation of an ornamental lighting system at the Fair Grounds, including approaches on Grand Avenue and Rock Island Avenue. H. R. Corey is secretary.

PAULLINA, IOWA. — Plans are being prepared for rebuilding the local power plant recently damaged by fire with loss of about $43,000.

SOLDIER, IOWA. — Bonds have been voted for the installation of a municipal electric plant.

NEWTON, MO.—The proposal to grant the North Missouri Power Company, Excelsior Springs a franchise to furnish electricity in Newton has been approved by the voters.

ST. LOUIS, MO.—The St. Louis Terra Cotta Company, 511 Manchester Avenue, plans to install electric power equipment at its proposed plant on Oleatha Avenue, to cost about $100,000.

GRAND FORKS, N. D.—Plans are under consideration for the installation of a Diesel engine, generator and auxiliary equipment at the municipal electric plant.

OMAHA, NEB. — The Nebraska Power Company is planning to construct a service and operate building at Forty-third and Worth Streets, to cost about $160,000. Frederick S. Scott, Kennedy Building, is architect.

FORT SCOTT, KAN. — The Council is considering calling an election to vote on the proposal to issue $200,000 in bonds for a municipal electric plant.

OAKLEY, KAN.—Plans are being considered for the erection of a transmission line from the municipal electric plant to Grinnell and Grainfield, for which a fund has been approved.

Southern States

GREENVILLE, N. C.—Bids will be received by the Water and Light Commission until Jan. 24 for one 1,250-kw. steam turbogenerator and switchboard for the municipal electric light plant. Ed. E. Williams, Greenville, is engineer.

HAYESVILLE, N. C. — The Hayesville Light & Power Company, recently organized, has acquired the plant of the Public Service Company and plans to develop 125 hp.

STAR, N. C.—The Norfolk Southern Railroad Company, Norfolk, Va., contemplates enlarging its local yards and building a refrigerating plant.

AUGUSTA, GA.—Bids will be received at the United States Veterans' Bureau, Room 791, Arlington Building, Washington, D. C., until Feb. 4 as follows: Part 1—For construction of buildings, etc., and electric freight elevator. Part 2—Plumbing, sewerage and water-supply systems. Part 3—Heating and steam distributing systems. Part 4—Lighting systems for each building, power systems and telephone conduits in certain buildings, and outside electric distributing and street-lighting systems, including transformers, panelboards, fixtures, conduits, ducts and wiring. Part 5—Remodeling buildings, including plumbing, lighting and heating.

BRADENTOWN, FLA. — Arrangements have been made by the City Council for extending the ornamental lighting system to several additional streets.

ORLANDO, FLA.—W. S. Barstow & Company, 50 Pine Street, New York, are said to be negotiating for the purchase of the Cheney power interests in this section, including plants at Leesburg, DeLand, Daytona Beach and Lake Wales. Extensions and improvements will be made to the systems.

LEBANON, TENN. — The Tennessee Power Company, Chattanooga, is negotiating for the purchase of the local electric plant and distributing system. If taken over, improvements, to cost about $25,000, will be made. The company now furnishes electricity to operate the system.

BIRMINGHAM, ALA. — The Alabama Power Company, it is reported, has been granted permission by the Public Service Commission to make extensions to its Warrior River reserve steam plant in Walker County, to cost about $700,000. The work will include the installation of a 20,000-kw. steam turbine electric generating unit, with necessary boilers and auxiliaries.

JACKSON, MISS.—The Mississippi Power & Light Company is planning to erect a transmission line from Jackson to Clinton. Transmission-line extensions are also contemplated to the communities adjacent to the towns of Vicksburg, Jackson, Columbia and Greenville, to furnish electricity to the farming and industrial districts.

HOT SPRINGS, ARK. — Preliminary plans are being prepared for an ornamental lighting system in the downtown section of the city. C. H. Milburn, City Hall, is engineer.

BATON ROUGE, LA.—The Baton Rouge Electric Company has tentative plans for the installation of additional equipment. The company is also considering enlarging its plant.

GIBSLAND, LA.—Bonds to the amount of $60,000 have been voted for improvements to the electric light plant and the installation of a new street-lighting system. E. T. Archer & Company, New England Bank Building, Kansas City, Mo., are engineers.

HOUSTON, TEX.—The Houston Lighting & Power Company has been granted a permit to install underground conduits on Walker Avenue.

MINERAL WELLS, TEX.—W. A. Fitts and E. R. Holland contemplate installing a lighting system on tract of 75 acres of land now being developed for residential purposes.

OMAHA, TEX.—Plans for the proposed local cotton mill to be erected by H. M. Farrier, Omaha, and associates, to cost about $300,000 include a power plant.

PITTSBURGH, TEX.—The Home Light & Ice Company plans to erect transmission lines to Leesburg and Newsome to furnish electricity in those towns and also to farmers along the line.

Pacific and Mountain States

COLVILLE, WASH.—The Stevens County Power & Light Company contemplates extending its transmission line to the Old Dominion Mine.

LEAVENWORTH, WASH.—The Washington Coast Utilities Company, Wenatchee, has applied to the City Council for a franchise here. If granted, the company proposes to purchase the local plant and to expend $20,000 in rebuilding lines and other improvements.

NEW DUNGENES, WASH. — Bids will soon be asked by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for rebuilding the power plant at the local radio compass station. (Specification 4938.)

SEATTLE, WASH. — The Puget Sound Power & Light Company has applied for permission to construct a dam and hydro-electric plant on the Sultan River, Snohomish County, to develop about 4,000 hp. The initial development will cost about $600,000.

TACOMA, WASH.—Bids will be received by the City Council until Jan. 21 for a bond issue of $4,000,000 for the construction of the first unit of the hydro-electric plant at Lake Cushman, with transmission lines.

WALLA WALLA, WASH.—The construction of a municipal electric plant, to cost about $750,000, is reported to be under consideration.

BEND, ORE.—The Bend Water, Light & Power Company contemplates building a hydro-electric plant on the Tumalo River to develop about 5,000 hp.

COMPTON, CAL.—Steps are being taken for extensions and improvements in the street-lighting system.

DAVIS, CAL.—Work will soon begin on the construction of the proposed new repair shops of the Pacific Gas & Electric Company. A new substation will be erected later.

FULLERTON, CAL.—Plans for the proposed local plant of the Balboa Motor Corporation, to cost about $150,000, include a power house. Hamm & Grant, Ferguson Building, Los Angeles, are engineers.

LOS ANGELES, CAL.—The Council is perfecting plans for the installation of ornamental street-lighting systems on portions of Sixth Street, Canal Avenue and Topango Canyon Road.

LOS ANGELES, CAL.—The Southern California Edison Company has arranged an appropriation of $26,288,000 for extensions and improvements during the present year, including hydro-electric development in the Big Creek section and additional steel-tower transmission lines.

PINE KNOT, CAL.—The Bear Valley Utility Company, Pine Knot, has applied to the State Railroad Commission for permission to supply electricity for lighting and power purposes and to distribute water in Big Bear Valley.

POMONA, CAL.—Improvements involving an expenditure of about $1,000,000, in the Pomona district this year are contemplated by the Southern California Edison Company.

REDONDO BEACH, CAL.—The Kroyer Tractor Company, Stockton, plans to build a power house at its proposed local plant, to cost about $100,000.

SAN DIEGO, CAL.—The Consoldiated Gas & Electric Company is arranging a fund of $2,500,000 for extensions and improvements during the coming year.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company plans to reconstruct its transmission line from the Colgate station to Vernon, about 50 miles. An appropriation of $44,500 has been made for the first 10 miles, from Vernon to Nicolaus. The company will also reconstruct its line from Cordelia to Petaluma.

SAN LUIS OBISPO, CAL.—The Midland Counties Light & Power Company is planning to erect an outdoor substation to serve San Luis Obispo.

BOISE, IDAHO.—The construction of a hydro-electric power plant, either at Arrowrock or Black Canyon Dam, to cost about $450,000, is under consideration by the Gem Irrigation District.

SALT LAKE CITY, UTAH.—The Utah Power & Light Company has filed application with the State Engineer for permission to use 2,500 second-feet of water from Bear River in Box Elder County and the right to store 75,000 acre-feet of water from the same source.

COLUMBUS, MONT.—Permission has been granted the Mineral Range Power Company to build a hydro-electric plant on Woodbine Creek.

DENVER, COL.—A. E. Humphreys, care District Forester, Post Office Building, Denver, has applied to the Federal Power Commission for a license to build an 85-ft. dam across Goose Creek, with power house, etc., on Goose Creek in Mineral County.

Canada

VICTORIA, B. C.—Tenders, it is understood, will soon be asked by the British Columbia Electric Railway Company for insulators in connection with the extension of the high-tension transmission line from Jordan River to Brentwood Bay. The cost is estimated from $10,000 to $15,000.

OAKVILLE, ONT.—The Town Council is considering the installation of a fire-alarm system, to cost about $5,000.

HALIFAX, N. S.—The Nova Scotia Power Commission plans to develop the water power of Ruth Falls on East River, at Sheet Harbor. The project includes a dam 800 ft. long and 20 ft. high, a canal 8,000 ft. long leading to power house, penstock structure from lower end of the canal to power house, etc. K. H. Smith is chief engineer.

LONDON, ONT.—Plans are under consideration by the Hydro-Electric Power Commission of Ontario for the erection of a steel-tower 110,000-volt transmission line from London to Sarnia, a distance of 70 miles.

Electrical Patents

Announced by U. S. Patent Office

(Issued Dec. 18, 1923)

1,477,892. HANDLAMP; A. P. Paine, New Haven, Conn. App. filed June 9, 1920. Special switch for flashlight.

1,477,898. AMPLIFYING SYSTEM; C. W. Rice, Schenectady, N. Y. App. filed Feb. 11, 1919. Amplification of high-frequency currents used for signaling purposes.

1,477,899. HIGH-FREUQENCY SIGNALING SYSTEM; C. W. Rice, Schenectady, N. Y. App. filed July 27, 1921. System for receiving high-frequency radio signals.

1,477,982. ELECTRICAL HEATER; R. R. Shriver, Rinard, Iowa. App. filed Oct. 13, 1922. For melting ice and snow on railway switch.

1,478,005. SIGNALING SYSTEM; J. C. Field, Orange, N. J. App. filed Aug. 24, 1920. Selectively operated circuit-controlling devices of step-by-step type.

1,478,007. AUTOMOBILE DIRECTION INDICATOR; F. O. Gray, Harvard, Ill. App. filed May 8, 1920.

1,478,008. SIGNALING SYSTEM; J. B. Harlow, Upper Montclair, N. J. App. filed July 5, 1919. Telephone-exchange apparatus.

1,478,011. ELECTRICAL SYSTEM; W. A. Turbayne, Niagara Falls, N. Y. App. filed March 29, 1920. Variable-speed generator and battery such as car-lighting system.

1,478,012. ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINE; T. W. Varley, New York, N. Y. App. filed April 8, 1920. Control of power factor.

1,478,014. SWITCHBOARD INCANDESCENT LAMP; H. T. Bellamy, Oak Park, Ill. App. filed June 23, 1919. For telephone switchboard.

1,478,022. TELEPHONE SYSTEM; W. W. Carpenter, Brooklyn, N. Y. App. filed Dec. 22, 1920. Machine-switching apparatus.

1,478,024. COMBINED TELEPHONE AND TELEGRAPH SYSTEM; H. P. Clausen, Mount Vernon, N. Y. App. filed Sept. 19, 1919.

1,478,029. RADIO RECEIVING SYSTEM; L. de Forest, New York, N. Y. App. filed July 2, 1920. Undamped wave apparatus.

1,478,037. TELEPHONE-EXCHANGE SYSTEM; C. W. Keckler, Newark, N. J. App. filed Dec. 26, 1919. Private branch exchange of automatic central office.

1,478,047. RADIO RECEIVING SYSTEM; J. Mills, Wyoming, N. J. App. filed Dec. 22, 1920. Reduction of static interference.

1,478,050. MODULATION CIRCUITS AND MEASUREMENT; E. L. Nelson, East Orange, N. J. App. filed April 26, 1922. For indicating degree of modulation.

1,478,051. RELAY; H. W. Nichols, Maplewood, N. J. App. filed April 16, 1920. Operating relays of polarized and alternating-current types used in telegraphic systems.

1,478,057. ADJUSTABLE TROLLEY-FROG DEVICE; H. A. Pharo, Pittsburgh, Pa. App. filed June 29, 1922.

1,478,066. LIGHTING AND POWER FIXTURE; A. T. Sampson, Lynn, Mass. App. filed Feb. 19, 1920. Can be installed in and connected to existing circuits.

1,478,072. VACUUM TUBE; H. J. van der Bijl, New York, N. Y. App. filed March 20, 1918. Buckling of anode and grid with large currents prevented.

1,478,074. TELEPHONE TRANSMISSION MOUTHPIECE; L. Van Rutten, Antwerp, Belgium. App. filed April 5, 1922. Inverted-cup-shaped, having small openings for sound waves.

1,478,076. ELECTRON DISCHARGE DEVICE; H. W. Weinhart, Elizabeth, N. J. App. filed Aug. 7, 1919. Arbor employed for supporting electrodes eliminated.

1,478,078. EQUALIZING NETWORK; E. C. Wente, Port Washington, N. Y. App. filed July 6, 1921. By receivers unequally responsive to different frequencies.

1,478,079. ELECTRICAL DISTRIBUTION SYSTEM; L. C. Wescoat, Corona, N. Y. App. filed Sept. 24, 1921. Automatic emergency supply source.

1,478,086. TELEPHONE-EXCHANGE SYSTEM; S. B. Williams, Jr., Brooklyn, N. Y. App. filed April 17, 1918. Automatic switches for distributing calls.

1,478,087. VACUUM TUBE; W. Wilson, Maplewood, N. J. App. filed Nov. 21, 1919. Electrode structure.

1,478,090. ELECTRIC SIGNAL FOR INTERNAL-COMBUSTION ENGINES; A. C. Wood, Chicago, Ill. App. filed Sept. 9, 1922. To indicate temperature conditions.

1,478,119. ELECTRIC LIGHT CLUSTER SOCKET; M. Herskovitz, Chicago, Ill. App. filed Dec. 14, 1917. For either hanging or table lamps.

1,478,164. ROTOR FOR INDUCTION MOTORS; E. C. Ballman, St. Louis, Mo. App. filed Jan. 19, 1920. Method of connecting short-circuiting bars together.

1,478,166. ELECTRICAL CONNECTOR DEVICE; R. B. Benjamin, Chicago, Ill. App. filed May 9, 1918. Light socket.

1,478,196. STARTING AND LIGHTING SYSTEM; F. Allison, Detroit, Mich. App. filed May 29, 1920. Two-unit type for automobiles.

1,478,225. ELECTRIC WELDING OR FORGING APPARATUS; I. W. Henry, New York, N. Y. App. filed Sept. 12, 1921. Light apparatus for convenient handling on steel buildings.

1,478,226. ELECTRIC WELD FORGING MAT; I. W. Henry, New York, N. Y. App. filed Aug. 4, 1921. For welding structural steel.

1,478,243. COMBINED MOTOR STARTER AND GEAR SHIFTER; H. J. Murray, New York, N. Y. App. filed July 15, 1919. For automobiles.

1,478,252. BAR WINDING FOR ELECTRIC MACHINES; F. Punge, Muhlheim-Ruhr-Speldorf, and H. Toos, Muhlheim-Ruhr, Germany. App. filed Aug. 16, 1920. Construction of machines to prevent uneven distribtuion of flux.

1,478,262. TRANSFORMER AND APPLICATION OF THE SAME TO HEATING; H. E. Snodgrass, Summit, and T. M. Hunter, Newark, N. J. App. filed Feb. 18, 1921. For welding apparatus.

1,478,271. HEAT INDICATOR FOR ELECTRIC IRONS; A. Weiss, Pasadena, Cal. App. filed March 16, 1920. Gives definite temperature indications.

1,478,282. FLASHLIGHT; R. L. Hunter, Norfolk, Va. App. filed June 28, 1922. Adjustable focus.

1,478,302. METHOD OF AND APPARATUS FOR ELECTRIC WELDING; H. E. Snodgrass, Summit, and T. M. Hunter, Newark, N. J. App. filed March, 29, 1922. Transformer for giving flat-top wave.

1,478,310. ELECTRIC IRON AND STAND; E. W. Wells, South Brownsville, Pa. App. filed March 18, 1921. Iron only heated when on stand.

1,478,311. TROLLEY; J. T. Welsh, Schenectady, N. Y. App. filed July 19, 1922. Trolley-pole wheel construction.

1,478,319. ELECTRIC SOLDERING IRON; E. Young, New York, N. Y. App. filed Feb. 6, 1923. Adjustable heating element.

1,478,340. ELECTROLYTIC CELL FOR GENERATING OXYGEN AND HYDROGEN; I. H. Levin, New York, N. Y. App. filed Jan. 14, 1920. Unipolar type.

1,478,341. ELECTROLYTIC CELL; I. H. Levin, New York, N. Y. App. filed Jan. 14, 1920. Unipolar type.

1,478,342. ELECTRICAL AIR CONDENSER; R. C. Lewis, Providence, R. I. App. filed Jan. 31, 1921. Variable condenser for radio circuits.

1,478,363. HEATING UNIT FOR OVENS; W. F. Schaller, San Francisco, Cal. App. filed March 24, 1921. Resistor elements readily removable.

(Issued Dec. 25, 1923.)

1,478,375. ELECTRIC FURNACE; M. H. Bennett, Waterbury, Conn. App. filed July 18, 1918. Effective heating current of high frequency.

1,478,412. TELEGRAPH APPARATUS; C. E. Walton, Cincinnati, Ohio. App. filed Jan. 4, 1919. Signals transmitted and received according to full duplex or half duplex.

1,478,415. HEATER FOR INTERNAL-COMBUSTION ENGINES; E. L. Wiegand, Pittsburgh, Pa. App. filed Sept. 29, 1921. Electric manifold heater.

1,478,419. MACHINE-SWITCHING TELEPHONE-EXCHANGE SYSTEM; R. S. Bailey, Montclair, N. J. App. filed Feb. 20, 1920. Impulse sender in which complete signal is stored up and then released.

1,478,435. PORTABLE RHEOSTAT FOR ELECTRIC ARC WELDING; T. P. Him, Wilkes-Barre, Pa. App. filed June 13, 1921.

1,478,458. NETWORK-CONTROLLING CIRCUITS; D. Smith, San Francisco, Cal. App. filed Aug. 24, 1921. Telephone repeater apparatus.

1,478,518. CONVERTER FOR DIRECT-CURRENT GENERATORS; M. J. Hockley, Ridgway, Col. App. filed April 7, 1923. Machine for converting direct current to alternating.

1,478,545. AUDIPHONE; J. W. Bishop, Muskegon, Mich. App. filed Aug. 7, 1920 To facilitate hearing of deaf persons.

1,478,574. ACOUSTIC INSTRUMENT; A. Marr Manchester, England. App. filed Oct. 4 1921. Special apertured plate for telephone transmitters, phonograph reproducers, etc.